An assessment of the major environmental problems in India

Preamble

The socio-cultural roots of the present environmental crisis lie in the paradigms of scientific materialism and economic determinism which fail to recognize the physical limits imposed by ecological systems on economic activity. The economies must expand within ecosystems which have limited regenerative capacities. Contrary to the neoclassical theory of continuous material growth, economic activities directly undermine the potential for development through over-exploitation of natural resources, and indirectly compromise future production through the discharge of residuals. The entrenchment with quantitative growth as a major instrument of social policy is thus quite paradoxical.

The emergence of the concept of sustainable development in recent years has brought in the general realization that societal perceptions must shift towards ecological determinism so as to achieve qualitative growth within the limits of the ecosystem's carrying capacity. The carrying capacity based planning process, innovative technologies for enhanced material and energy effectivity of production and consumption, structural economic change towards less resource intensive sectors and preventive environmental management through increasingly interventionist policies are some of the strategies for reconciling developmental goals with ecological capabilities.

Indian Scenario

Economy

Economic growth in the Seventh Five Year Plan
The Indian economy, which had growth rates of around 4-5 percent during the period 1987-88 to 1990-91 (the growth rate was 10.9 percent in 1988-89), almost stagnated at 1.2 percent in 1991-92 (as against targeted 2.5 percent growth). The economy is expected to grow at over 4 percent in 1992-93. The economy went through a difficult period in 1991-92, and strong measures were undertaken to prevent a major economic crisis. The first nine months in 1992-93 has seen (a) an increase in exports of 3.4 percent in dollar terms, and (b) the index of industrial production has gone up by 3.8 percent. The deficit has also been contained at 2 percent of GDP, down from over around 8 percent during the previous years. The deficit is expected to be less than one percent of GDP in the year 1995-96. The economy continues to depend on agriculture with the sector accounting for a third of the share in national income.

The Eighth Five Year Plan and beyond

The Eighth Five Year Plan commenced on April 1, 1992. Among the objectives are (a) to achieve near full employment by the year 2000 AD, and (b) strengthening of infrastructure sectors (energy, transport, communication, irrigation) in order to support the growth process on a sustainable basis. The Plan has targeted an average growth of 5.6 percent per annum. Industrial policy reforms have been undertaken in order to gear up for the growth rate envisaged. Notable among the changes are that the private sector can now invest in oil exploration and refining as well as in power generation. The private sector includes domestic and foreign investment as well. The Eighth Plan also gives indications of some of the macro-parameters for the period beyond the Plan period, as is given in Table 1.

Table 1 : Some macro parameters of growth (1992-93 to 2006-07)

Period	GDP growth rate	Savings rate	Investment rate	Growth rate of consumption	Growth rate of per capita private consumption
1992-93 to 1996-97	5.60	21.60	23.17	5.60	3.49
1997-98 to 2001-02	6.05	23.20	24.20	5.62	3.89
2002-03 to 2006-07	6.51	24.40	25.40	6.18	4.59

The savings rate in the Seventh Five Year Plan was around 20 percent of GDP. Ar average saving rate of 21.6 per cent as observed towards the end of the Seventh Plan ha been considered achievable for the Eighth Plan. An increase of the same magnitude i expected in each of the next five year periods. Also, assuming that the current accoun deficit is maintained at the level of 1.6 percent of GDP till 1996-97 (even though th Economic Survey projects the deficit at one percent in 1995-96) and at 1 per cent thereafte for the subsequent periods, the investment rate is expected to increase from 23 percent i the Eighth Plan to 25.4 percent by the year 2006-07. An incremental capital output rati (ICOR) of 4.1 has been assumed for the Eighth Plan. ICOR is assumed to reduc marginally to 4.0 and 3.9 for the next two five year periods respectively. On this basi while the growth rate for the Eighth Plan would be 5.6 percent per annum, this is expecte to go up to 6.5 percent during the Tenth Plan.

Even a modest improvement in the rate of growth of the economy would give a boos to per capita consumption. The rate of growth of per capita private consumption throughou the period 1950-80 remained at a low of 1.05 percent per annum. There was a significan improvement in the eighties when this increased to 3.8 percent per annum. A growth rat of 3.9 percent in the Ninth Plan, and 4.6 percent per annum subsequently will amount t an increase of 80 percent in absolute per capita consumption levels over the next 15 years

Energy

Energy continues to play a key role in the development of the Indian economy. Th commercial energy intensity has been showing an upward trend over the last decade and it is expected that initiatives taken to bring down the commercial energy intensity should see a reduction in the energy intensity during the Eighth Five Year Plan and beyond. Th Eighth Five Year Plan points out that efficient use of energy and long term sustainability are two important objectives in economic planning.

India's per capita consumption of commercial energy at 208 kg oil replacement units is only one-eighth of the world average. The energy intensity of growth, on the other hand, is extremely high while energy efficiency remains low. With one unit input of energy, India produces only a half of what is produced in the developed countries. Further, for 1% growth in GNP, the country requires 2.02% energy growth.

The energy policy has always laid emphasis on expansion of capacity. Subsidised prices, which even fail to cover the costs, have discouraged energy saving and technological innovations. Some of the power stations in the country operate at efficiencies of barely 25%-30%. The loss of energy in electricity transmission is nearly 22%. As a result, despite annual increase in energy production to the tune of 8.9% in the 1980s, there continues to remain a gap of about 10% between demand and supply.

Another significant aspect of the energy scenario that is often overlooked by planners, is that cooking energy constitutes nearly half the energy used in the country, of which almost 90% comes from non-commercial sources such as firewood, cowdung and crop wastes. Further, farms and transport systems employ nearly 80 million work animals that just about match the country's vast electricity network in energy generation.

Commercial energy accounts only for a little over 50% of the energy use with industry as the major consumer of electricity and coal (62% and 78% respectively), and the transport and household sectors as the major consumers of oil (56% and 29% respectively).

Increased reliance on coal is the single major cause of air pollution and land spoilation in the country. Despite regulatory measures, the levels of air pollution in many regions have far exceeded permissible concentrations resulting in increased health risks and larger environmental threats such as global warming and acid deposition.

The combustion of non-commercial fuels as a source of cooking energy in the country has resulted in excessive exposure to indoor air pollution while depriving the soil of important nutrients that would otherwise be recycled through biomass decay. Moreover, the replacement of these nutrients with synthetic fertilisers is an energy intensive process representing the debit side of energy balance when biomass is combusted for energy recovery.

More than 80% of the hydroelectric potential in India still remains untapped primarily due to adverse environmental consequences of large-scale hydropower development such as deforestation, undesirable changes in riverine ecology and massive displacement of human communities. Decentralised, small-scale hydropower schemes are not yet used on a significant scale, although they possess the potential of providing economical, efficient and environmentally benign sources of energy.

With an installed capacity of 1 350 MW in 1987, nuclear energy constitutes 2.43% of the total power capacity. The nuclear energy programme aims at 10 000 MW of installed capacity by the turn of the century, contributing 10% of the total energy mix.

Biomethanation, which is an energy efficient and environmentally compatible process and could provide five times the energy yielded by combustion of non-commercial fuel sources, has been exploited only for substrates such as cowdung. The potential for biogas generation from other substrates largely remains untapped.
The concept of sustainability should not only take into account ecological balances but also issues relating to equity and self reliance.

The performance of the energy sector has fallen short of targets. While coal and power sectors did not meet targets, oil production has been declining since 1989-90. The Economic Survey (1992-93) has highlighted the need for (a) improving the productivity in the coal sector, (b) reduction in transmission and distribution losses in the power sector, and (c) improvement in the plant load factors in power generation. Another factor of concern is the decline in the relative share of railways in transport. This has associated impact on energy consumption.

Industry

Since the inception of planned development in the early fifties, India has established a well diversified industrial structure with a sizable capacity in basic and heavy industry. The share of value added to the GDP by the manufacturing sector is expected to rise from 14.6% in 1984-85 to 20% by the year 2000 AD with an average annual growth rate of 8%. The expansion in industry sector, however, has been towards capital and energy intensive sectors which are also most polluting sources.

Nearly 50% of the total industrial output in monetary terms is contributed by over 2 million small scale industries which also account for 60-65% of the total industrial pollution. Also, the use of toxic chemicals in industry has grown phenomenally. As per estimations of OECD derived from correlation between hazardous waste generation and economic activity, nearly 0.4 Mt of hazardous waste was produced in the country in 1989

The mining sector has growth from Rs.850 million worth in 1950 to over Rs.84.64 billion in 1986. Coal production constitutes the bulk of mining output with iron and limestone predominant amongst the metallic and non-metallic minerals respectively.

Only about 50% of the large/ medium scale industries have provided complete/ partial emission control systems and many of these do not achieve stipulated effluent standards. The small-scale industries (SSIs) have not yet been subjected to rigorous pollution control Despite joint treatment of wastes in case of few industrial estates, the SSIs, by and large have not availed the financial incentives introduced to enable small entrepreneurs to deal with pollution problems.

Environmental Problems: Nature and Dimensions

Environmental problems in India can be classified into two broad categories:

- Those arising as negative effects of the very process of development; and
- Those arising from conditions of poverty and under-development.

The firs tcategory has to do with the impact of efforts to achieve rapid economic growth and development and continuing pressures of demand generated by those sections of society who are economically more advanced and impose great strains on the supply of natural resources. Poorly planned developmental projects are also often environmentally destructive. The second category has to do with the impact on the health and integrity of our natural resources (land, soild, water, forests, wildlife, etc.) as a result of poverty and the inadequate availability, for a large section of our population, of the means to fulfil basic human needs (food, fuel, shelter, employment, etc.). Needless to say, the two problems are interrelated.

Our forest wealth is dwindling due to over-grazing, over-exploitation both for commercial and house-hold needs, encroachments, unsustainable practices including certain practices of shifting cultivation and developmental activities such as roads, buildings, irrigation and power projects. The recorded forest cover in the country is 75.01 million ha which works out to 19.5% of the total geographical area against the broad national goal of 33% for the plain areas and 66% for hilly regions. Even within this area, only 11% constitute forests with 40% or more of crown cover. According to the State of Forest Report, 1991, the actual forest cover in the country was 64.07 million hectares during 1987-89. The loss of habitat is leading to the Botanical and Zoological Surveys of India, over 1500 plant and animal species are in the endangered category. The biological impoverishment of the country is a serious threat to sustainable advances in biological productivity. Gene erosion also erodes the prospects for deriving full economic and ecological benefits from recent advances in molecular biology and genetic engineering.

Our unique wetlands, rich in aquatic and bird life, providing food and shelter as also the breeding and spawning ground for the marine and fresh water fishes, are facing problems of pollution and over-exploitation. The major rivers of the country are also facing problems of pollution and siltation. Our long coastline is under similar stress. Our coastal areas have been severely damaged due to indiscriminate construction near the water-line. Coastal vegetation including mangroves and sea grasses is getting denuded. Out mountain ecosystems are under threat of serious degradation. Extensive deforestation leading to the erosion of valuable topsoil is threatening the livelihood security of millions of hill people. Equally serious is the downsteam effects of the damage done upstream. Indo-gangetic agriculture, often described as a potential bread basket in the world, is being damaged beyond repair as a result of soil degradation. Some areas are facing problems of water-logging and rising water tables because of poorly planned and ill-executed irrigation. In other areas, the water table is receding because of over-exploitation of ground water. Furthermore, the quality of groundwater is being affected due to chemical pollution and in coastal areas, due to the ingress of sea water. The excessive use of fertilisers and pesticides impose threat to human health, to the genetic stocks and reduces the natural soil fertility in the long run. The absence of an integrated land and water use policy for the country is taking a heavy toll on these basic natural assets.

Coral reefs are the most productive marine ecosystems and provide habitat for diverse flora and fauna. These ecosystems are adversely affected by indiscriminate exploitation of coral for production of lime, recreational use and for ornamental trade. Similarly, the fragile environs of island ecosystems have been subjected to pressures of various forms including migration of people from the mainland.

Global atmospheric changes resulting in altered temperature and precipitation and rising ocean levels, are no longer within the realm of mere theoretical possibilities. Combination of local subsidence, greenhouse induced sea-level rise and coastal environmental degradation may lead to periodic floods, incursion of salt water, melting of glaciers and river flooding. Local changes of average rainfall will severely affect agriculture and water supply, especially in semi-arid areas.

A large number of industries and other development projects have been incorrectly sited, leading, on the one hand, to over-cogestion and over-pollution in our urban centres and on the other hand, to diversion of population and economic resources from the rural areas. This has also resulted in the pollution of most of our water bodies which are major constituents of our life support systems. Pollution of water bodies, in turn, has adversely affected the growth of aquatic fauna and flora which is an environmentally undesirable phenomenon for any ecosystem. The problems of women in villages is compounded in this whole scenario of energy, environmental and developmental imbalance. The incidence or malaria is high in many parts of the country. Safe drinking water is still a luxury in many villages. Liver ailments and gastro-intestinal diseases are common due to unclean drinking water.

It is difficult to clearly delineate the causes and consequences of environmental degradation in terms of simple one-to-one relationships. The causes and effects are often interwoven in complex webs of social, technological and environmental factors. For instance, from a purely scientific and technological standpoint, soil erosion would result from the cultivation of marginal lands. However, from the point of view of a comprehensive environmental impact analysis, it is important to go further backand analyse the circumstances that force people to cultivate marginal lands. Viewed in this light, it becomes clear that a concern for the evnrionment is essentially a desire to see that national development proceeds along rations, substainable lines. Environmental conservation is, in fact, the very basis of all development.

There is an increasing trend in environmental pollution. India's rivers and streams suffer from very high levels of pollution. Water is mainly polluted by four kinds of substances: traditional organic waste, waste generated from industrial processes, chemical agents for fertilisers and pesticides for crop protection and silt from degraded catchments. Untreated sewage and other nonindustrial wastes are the major cause, accounting for four times as much pollution as industrial effluents. For Class I cities of the country, less than five per cent of the total waste water generated is collected and less than one-fourth of this is treated. A consequence of such pollution is high levels of waterborne diseases, which account for two-thirds of all illnesses In India. **(Details given in Annexure)**

Ambient air quality trends in the major cities indicate that levels of suspended particulate matter are higher than the prescribed standards or limits, especially in summer months. Levels are much higher than any comparable areas of Europe and North America. Sulfur dioxide levels in nine of the 10 major cities exceed national standards. Contributors to air pollution include power stations, industrial factories, automobiles and the fuels - including coal, dung and trash -- burned for domestic energy needs. Levels of nitrogen dioxide are increasing in urban centres with growing vehicle emissions mostly in high traffic density areas. To counter the problem, it is considered that strict standards for exhausts at manufacturing stage is the most important measure. Accordingly, such standards for 1995 and 2000 AD have been evolved and forwarded to the Government for its consideration. **(Details given in Annexure).**

India's soil resources are endangered. Soils covering 20 percent of the country are at least partially degraded as a result of overgrazing, deforestation and improper irrigation practices. Overcultivation has depleted some soils of nutrients. Use of marginal lands is widespread because of dire need.

Government's Initiatives for Environmental Improvement

Background

The Constitution of India contains a direct commitment to environmental protection. The Article 48-A of the Indian Constitution stipulates that "the State shall endeavor to protect and improve the environment and to safeguard the forests and wildlife of the country".

The VIIth Schedule of the Constitution classifies the various legislative subjects into 3 categories, namely, Union List, State List and Concurrent List. The legislations in respect of the topics given in the Union List are enacted by the Parliament, while in respect of items included in the State List, the State Legislatures are empowered to enact the necessary legislation. The third category, the Concurrent List, specifies the subjects that are to be looked after jointly by the Central and the State Governments. Though the subject "Environmental Pollution Control", as such, does not figure anywhere in these lists, the various individual sectors are specifically provided for in one or the other of these lists.

India's Policy

The Government's policy states that to achieve the objective of pollution control, maximum use will be made of a mix of instruments in the form of legislation and regulations, fiscal incentives, voluntary agreements, educational programmes and information campaigns. The emphasis will be on increased use of regulations and an increase in the development and application of financial incentives. It is, however, not enough for the government to notify laws which are to be complied with. A comprehensive approach is taken to integrate environmental and economic aspects in development planning; stress is laid on preventive aspects for pollution abatement and promotion of technological inputs to reduce industrial pollutants; and through reliance upon public cooperation in securing a clean environment to respond to the coming challenges. The objective is to integrate environmental considerations into decision making at all levels. To achieve this, steps have to be taken to:

- prevent pollution at source;
- encourage, develop and apply the best available practicable technical solutions;
- ensure that the polluter pays for the pollution and control arrangements;
- focus protection on heavily polluted areas and river stretches; and
- involve the public in decision making.

Environmental legislation in India

Following environmntal acts have been notified till date.

- The Wildlife (Protection) Act, 1972, amended in 1983 and 1991...
- The Water (Prevention and Control of Pollution) Act, 1974, amended in 1988.
- The Water (Prevention and Control of Pollution) Cess Act, 1977, amended in 1991.
- The Forest (Conservation) Act, 1980, amended in 1988.
- The Air (Prevention and Control of Pollution) Act, 1981, amended in 1988.
- The Environment (Protection) Act, 1986.
- The Motor Vehicle Act, 1938, amended in 1988.
- The public Liability Insurance Act, 1991.
- A Notification on Coastal Regulation Zone, 1991.

Details of the above

In accordance with the constitutional provisions, the Water (Prevention and Control of Pollution) Act, 1974 was promulgated under Article 252, as water is a State subject. On the other hand, the Air (Prevention and Control of Pollution) Act, 1981, was passed under the provisions of the Article 253, since air does not figure in the Central or State list.

The catastrophic leakage of methyl isocyanate (MIC) gas from the Union Carbide Factory in Bhopal, which took a toll of 2000 lives and many more who had been adversely affected, brought out the need for providing "Teeth" to the Acts for deterrent action where warranted. It was also felt necessary to have an umbrella legislation for taking necessary measures with various aspects of environmental concern including those which are not covered under the existing laws. Thus, in the wake of the Bhopal disaster and in recognition of the need for a comprehensive legislation, the Environment (Protection) Act, 1986 was brought into force with effect from 19th November 1986.

Since the Act came into force, several steps have been taken to provide legal and institutional basis for implementation of the Act. These include framing of rules, notification of standards, enlisting environmental laboratories, strengthening of State Departments of Environment and Pollution Control Boards, delegation of powers, identification of agencies for carrying out various activities for hazardous chemicals management and setting up of Environment Protection Councils in various States.

As the present system of jurisprudence does not provide for compensation to individuals for environmental damage, including damage caused by pollution, it is proposed to set up special legal institutions to redress this deficiency and also make adequate arrangements for interim relief. The Public Liability Insurance Act, 1991 has been enacted to provide for mandatory insurance for the purpose of providing immediate relief to the persons affected by accident occurring while handling any hazardous substance. The Act has come into operation w.e.f. 1st April 1991. Public interest litigation has successfully demonstrated that responsible non-governmental organisations and public spirited individuals can bring about significant pressure on polluting units for adopting abatement measures. A legislation for setting up a National Environmental Tribunal and codification of strict liability for damages arising out of any accident or incident involving hazardous substances has been prepared and is under finalisation.

Institutional structure

- Department of Environment in 1980 and the integrated Ministry of Environment and Forests in 1985, Department of Science and Technology, Department of Agriculture and Cooperation, Department of Biotechnology, Department of Ocean Development, Department of Space, Department of Non-Conventional Energy Sources, Energy Management Centre, Council of Scientific and Industrial Research etc. at the Centre, Departments of Environment at the State and Union Territory level.
- Central Pollution Control Board and State Pollution Control Boards.
- Central Forestry Board.

- Indian Council of Forestry Research and Education with specialised institutions for research in arid zone, forestry, moist and deciduous forests, wood technology, genetics and tree breeding and deciduous forests.
- Forest Survey of India (FSI) and the Wildlife Institute of India (WII) in addition to the existing organisations like Botanical Survey of India (BSI) and Zoological Survey of India (ZSI).
- National Landuse and Wasteland Development Council.
- National Wastelands Development Board.
- Indian Board of Wildlife.
- National Museum of Natural History, Centre for Environmental Education, Institute for Himalayan Environment and Development and Centres of Excellence in specialised subject areas are among the various institutions set up.

Details of above

The CPCB is the apex Board, under the MoE&F, GOI, which co-ordinates and guides all SPCBs. The standards and regulations regarding pollution are framed only by the CPCB/MoE&F. Under the Water Act, the CPCB at the Centre and SPCBs in the States are functional since 1974. The CPCB and the SPCBs are responsible for carrying out the functions entrusted to them under the provisions of the Water Act, 1974 and Air Act, 1981 respectively. Legal action under these two Acts is taken by the respective SPCBs.

CPCB is also required to provide assistance to the State/UT's Department of Environment for setting up of Technical Cells with technical/ non-technical staff to deal with the environmental problems as well as to function as a coordinating agency. Recently, the work of recognition of environmental laboratories and analysts under EPA, 1986 has also been transferred to the CPCB. However, the MoE&F would be considering the cases of private laboratories.

The primary functions of Boards are :

- enforcement of environment protection laws, enumerated above
- issue No Objection Certificates (NOCs) to new industry for locational clearance
- issue consent order to industries to allow them to discharge pollutants on land, water bodies and in atmosphere
- set up standards for permissible quality of treated effluent before final disposal
- monitor the quality of wastes as per consent orders
- collect fees, cess
- publish technical and statistical date related to pollution
- disseminate information on pollution through seminars, workshops, exhibition, etc.

Besides the PCBs, almost all the states also have a Department of Environment and Forests. These departments oversee the SPCBs, co-ordinates with the forests department, industrial ministries and other environment related ministries or department.

Environmental quality standards

The MoE&F, under the EPA 1986, frames EPA Standards. These standards refer to the maximum limit of concentration of pollutants in the effluent and emission discharges. This is done with the help of a committee, comprising of CPCB, other Government Departments and leading pollution control consultants, as members. The Ministry publishes these standards in the Central Gazzettes. These standards become the National Standards, to be followed by all industries in the country. These standards cannot be relaxed, but can be made more stringent by the SPCBs. CPCB has setup Minimum National Standards (MINAS) which are by themselves not statutory. However, when SPCBs adopt them, these become legal standards. EPA standards are statutory to the state. Industry-specific standards for water use and wastewater generation (quantum limits) have been finalised in respect of the following industries, which have subsequently been notified under EPA rules:

- Integrated iron and steel; sugar; fertiliser - nitrogenous and phosphatic (SSP & TSP) excluding manufacture of any acid, and complex fertiliser; small pulp and paper agro-residue and waste paper based; large pulp and paper - paper and rayon grade pulp; fermentation - maltry, brewery and distillery; caustic soda - mercury cell and membrane cell processes; textiles - manmade fibre: nylon and polyester and viscose rayon; tannery; natural rubber; and starch, glucose and related products.

The load-based standards for the above industries are arrived at by taking into account the existing permissible concentrations (MINAS) and the wastewater generation quantum limit. To act against potential problems in the future, new units will have to conform to stricter standards. They will need to select technologies that produce no or low quantities of wastes and recycle or reuse waste products. Progressively, more strict vehicle emission standards will also be evolved to deal with environmental hazards caused by vehicular traffic.

The present standards are based on the concentration of pollutants in effluent and in emissions. However, mass based standards have recently been laid to set specific limits to encourage the minimisation of waste, promote recycling and reuse of materials as well as conservation of natural resources particularly water. Since the standards will be source related, they will require for the most polluting industrial processes, particularly those using toxic substances, application of the best available technological solutions, and also be an instrument for technological upgradation. Water Cess is levied under the Water Cess Act, 1977, and collected by the respective SPCBs in the States and CPCB in the Union Territories. The amount so collected is shared between Centre and States. Centre's Share of the cess is disbursed to SPCBs to augment their resources in order to meet the requirements/ functions assigned to them under the Pollution Control Laws. Recently, the Water Cess (Amendment) Bill, 1991 has been passed by both the Houses of Parliament. The amendments have been proposed with a view to augment the resources of the PCBs, lacunae in the Act and to provide rebate to the industries for complying with the consumption and effluent quality standards.

Standards will not merely be a regulatory tool but will be mechanism to promote technological upgradation to prevent pollution, conserve resources and regulate waste. For this purpose codes of practice and guidelines will be evolved for specific processes.

Fiscal measures

While regulatory measures remain essential for the effectiveness of the policy, new approaches for considering market choices will be introduced. The aim is to give industries and consumers clear signals about the cost of using environmental and natural resources. The expectation is that market-oriented price mechanisms will influence behaviour to avoid excessive use of natural resources.

There are at present several fiscal incentives for installation of pollution control equipment and for shifting polluting industries from congested areas. The items for which excise and customs rebate are allowed will be reviewed. This will stimulate the advancement of abatement technologies and create increased demands for the products.

Economic instruments will be investigated to encourage the shift from curative to retentive measures, internalise the costs of pollution and conserve resources, particularly water. A direct economic signal is offered by an effluent charge based on the nature and volume of releases to the environment. The level will be based on the cost of treatment and the flow discharged, in order to provide an incentive to set up treatment plants. The scope of the charges will also be extended to emissions and solid waste. Charges provide a continuing incentive towards optimal releases.

These instruments will also have a distributive effect as the revenues will be used for enforcement, collective treatment facilities, research and promoting new investment.

The precise choice of economic instruments adopted will be determined by the ease with which releases can be measured, as well as prospective changes in technology and market structures. To deal with the range of pollution problems a mix of regulatory and economic measures will be adopted.

Environmental Impact Assessment studies of development projects

- Establishment of procedures for environmental impact assessment and clearance with regard to selected types of projects requiring approval of the Government of India.
- Prior clearance of projects diversion of forests for non-forest purposes under the Forest (Conservation) Act, 1980.
- Formulation of Environmental guidelines for projects in various sectors.

In order to ensure the integration of the environmental considerations with development projects right at the planning stage, procedures have been instituted for environmental (including forestry) clearance of projects before approval for investment. At present the following categories of projects are assessed by the MoE&F.

- Thermal Power Projects.
- Atomic Power Projects.
- Mining Projects of Public Sector Undertakings.

- Industrial Project
(a) requiring the clearance of the Expenditure Finance Committee or the Public Investment Board of
(b) requiring international funding, or
(c) those projects referred specifically to MoE&F by the State Governments or the respective administrative Ministries or
(d) those taken up for scrutiny by the MoE&F due to public complaints

- All projects being put up before Cabinet Committee on Economic Affairs (CCEA) or Public Investment Board (PIB) such as Ports and Harbours, Communication Projects, etc.

- Projects in certain areas such as Doon Valley and the islands taken up for scrutiny because of the ecologically fragile nature of the areas.

- Tourism projects including beach resorts, which violate the guidelines regarding prohibition of any activity within 500 metres of the high tide line of the sea.

- Other projects such as constructions in violation of the existing rules brought to the notice of the Ministry of Environment and Forests.

Environmental quality monitoring

Air Quality Monitoring

The National Ambient Air Quality Monitoring Programme (NAAQM) started in 1984 with 28 stations spread over 7 cities. Over the years, a number of major cities and industrial towns have been covered and the total number of stations, now, is 290 covering 99 cities. The results of statistical analyses of data pertaining to 1990, in terms of sulphur dioxide, nitrogen dioxide and suspended particulate matter in the residential areas of monitored cities are presented in the Annexure.

The significant observations based on 1990 data are given below:

- For sulphur dioxide, at 11 NAAQM locations in Ahmedabad, Bombay, Madras, Gajraula and Howrah, the violations over the 24-hourly average standards were in the range of 5 percent. At locations in Madras, Calcutta and Howrah, the range of violations were 5-10 percent. Only Naskarpara Pump House in Howrah is the location where SO_2 (19%) violated the 24-hourly average standard by more than 10%.

- In 1990, at three locations, the percent violation for SPM over the 24-hourly average standard were more than 80%. These locations are: Raipur Road, clock tower in Dehradun and E.S.I. Hospital in Agra with 100%, 90%, and 80% violations respectively.

Water Quality Monitoring

Inland Water Quality Monitoring (WQM) is currently being done under three major programmes, namely:

- Global Environmental Monitoring System (GEMS)
- Monitoring of Indian National Aquatic Resources (MINARS)
- Ganga Action Plan (GAP)

As on March 31, 1992, there are 480 WQM stations, of which 51 are under GEMS, 402 under MINARS, and 27 under GAP. Out of the 480 stations, distributed all over the country, there are 422 stations on rivers, 26 groundwater stations and 32 on lakes and creeks. A detailed analyses of the data collected from these stations reveals that the critical parameters for the water pollution are the Total coliforms, BOD. The critical river stretches which had been identified in the Action Plan, are the polluted areas of Sabarmati, subernarekha, Godavari, Krishna, Indus (Tributaries), Satluj, Ganga (Tributaries), Yamuna, Hindon, Chambal, Damodar, Gomati and Kali.

Coastal Water Quality Monitoring

A monitoring network of 173 stations were established during the seventh five year plan over the entire coast line of the country at varying distances from the coast to assess the quality of the coastal and estuarine waters. This programme was jointly taken up by the Department of Ocean Development (DOD) and Department of Environment (DOE). Out of these 173 stations, the Central Pollution Control Boards of Gujarat, Maharashtra, Kerala and Tamil Nadu, and the East Zonal Office of the Central Board, Calcutta. The remaining 66 stations were monitored by the Department of Ocean Development through various agencies.

Industrial pollution control

Environmental management in small scale industries

Small scale industries are a special feature of our economy. In India, over 2 million small-scale industries are existing and about 2000 industrial estates have come up. Collecting full details of each individual small-scale units in the country is quite difficult at any stage; and hence it is decided to collect data of small-scale units in an organised industrial estate/cluster of small-scale units. Though small-scale industry as a unit may not be severe in pollution, a cluster of these industries may severely pollute the environment. There are certain industrial estates which are critically polluting the environment. Such critical industrial estates need a detailed survey to establish the feasibility of setting up of Common Effluent Treatment Plant (CETP). With this objective the CPCB has taken up the study of critically polluted industrial estates with the assistance of SPCBs. A subsidy of Rs.25 lakhs or 25% whichever is less is being given to clusters of SSIs for setting up CETPs, subject to the State Government put in a matching contribution. This scheme will be extended to provide necessary technical support as well. While the large and medium industrial units will remain totally responsible for control of their pollution, assistance will be provided to SSIs by promoting development and adoption of cleaner technologies, including environmentally friendly biotechnology.

Environmental management in medium and large scale industries

The CPCB has selected 18 categories of major polluting industries for priority action. Pollution control status of industries in these 18 categories, in 23 States and Union Territories (including all major industrial states) have been collected, collated and compiled and defaulting units have been identified. The Ministry initiated a 15 Point Action Plan to control pollution in these industries and has directed SPCBs to ensure the compliance of Standards in these industries. Pollution Control Status of 18 categories of industries in 23 States/Union Territories including all major industrial estates have been collected, collated and compiled. Defaulting units have been identified and actions are being taken against them.

Implementation and enforcement of standards: National and Zonal Task Forces have been constituted for the implementation of standards in the industries like Fertilizer, Iron and steel, Thermal power plants, Cement, Pulp and paper and Oil refineries. The main functions of the task forces are;

- to create a forum for industries and SPCBs to interact with a view to hastening the process of compliance of standards.

- to disseminate to the industries, the latest technologies available for control of pollution in specific industries.

- to prepare status of compliance at national level for respective industrial category.

These Task Forces interact with the concerned industry representatives and SPCBs and also take up inspection of pollution control systems installed at sources and monitor the progress of implementation of standards. The status of implementation of standards in respect of some major industries are given below.

Table : Implementation of Standards in Industry

	Cement	Thermal Power	Pulp & Paper	Fertilizer	Oil Refineries	Sugar	Distil
No. of units complying with emission standards	62	23	-	44	6	-	-
No. of units complying with effluent standards	-	-	118	62	6	180	74
No. of units committed to a time-bound programme/ have partial treatment	21	42	99	-	-	95	70
No. of defaulting units	5	-	100	14	-	88	63
No. of units closed	6	3	-	3	-	03	04

Details of the nation wide compliance are given in the Annexure.

Environmental Audit : The concept of Environmental Audit has been proposed by the MoE*F for the assessment of development projects not only at the beginning of the project but also on a regular basis. It has also been proposed that every person carrying on an industry, operation or process requiring consent under the Water (Prevention and Control of Pollution) Act, 1974 or the Air (Prevention and Control of Pollution) Act, 1981 or both or authorisation under the Hazardous (Management and Handling) Rules, 1989 shall submit an Environmental Audit Report for the Financial Year ending the 31st March in the form prescribed by the Government to the concerned State Pollution Control Board on or before the 30th day of September every year, starting from 1993.

The report would include steps taken or proposed to be taken in the following:

- Adoption of clean technologies for prevention of pollution
- Waste minimisation

- Waste recycling and utilisation
- Pollution control measure
- Investment on environmental protection
- Impact of the measures taken on waste reduction and other resource conservation.

To start with, the CPCB has undertaken environmental audits in selected units belonging to the 18 categories of major water/air polluting industries. The objective of this indepth study is to evaluate the performance of the pollution control systems to identify good pollution prevention and control system for demonstration. The industries were selected on the basis of the following :

- Industries which claim to be complying with effluent/ emission standards and/ or under consideration for awards for proper environmental management by MoE&F/ Ministry of Industry;

- Industries adopting clean technologies for practising recycle/ reuse to minimise waste production which can be demonstrated to other non-compliant industries; and

- Industries which have not yet provided pollution control systems, where pollution problems can be studied.

Management of hazardous substances

A set of rules has been prepared in 1989 to regulate the handling of hazardous chemicals, hazardous micro-organisms/genetically engineered organisms and hazardous wastes. Amendments to these rules are under consideration to make them more comprehensive. A notification restricting the use of benzidine and benzidine based dyes in the country has been issued. Steps were initiated to restrict the use of other harmful substances like pesticides, Penta Chloro Phenol (PCP) etc. A set of rules on the transportation of hazardous chemicals by road has been notified by Ministry of Transport under Motor Vehicles Rules, 1989. A few amendments indicating the responsibilities of the occupier/ transporter/ driver etc., have been drafted for inclusion in the proposed amendments to the Motor Vehicles Rules, 1989. Guidelines on siting of hazardous wastes treatment, disposal facilities and identification and assessment of abandoned hazardous wastes sites have been prepared. Off-site/on-site emergency preparedness plan are also required to plan mitigative measures in terms of response time, resource mobilisation and effectiveness in case of accidents. A Red book entitled "Central Crisis Group Alert System" has also been prepared.

ECOMARK for environment friendly products

The Scheme of labelling of Environment Friendly Products was notified on February 21, 1991. The scheme which will be operated on National basis envisages accredition and labelling of household and other consumer products which meet certain environment criteria, alongwith the quality requirements of Indian Standards. The label shall be known as "ECOMARK". A National Steering Committee for implementation of the ECOMARK Scheme has been constituted. A Technical Committee constituted to assist the National Steering Committee would identify the individual products and determine the criteria for awarding the ECOMARK. Criteria for the following product categories, viz., toilet soaps and detergents, etc. have been notified in the first phase.

Identification of Problem areas

The Central Government in consultation with the States have evolved an action plan for controlling pollution from the heavily polluting industries, critical areas and control of critical pollutants. In an attempt to counter the environmental problems in an integrated way at areas seen to be problematic, seventeen such areas were initially identified. Two more areas, Parwanoo and Kala Amb were later added to make a total of nineteen. The identified problem areas have been surveyed and time targetted action plans are being framed out in consultation with the respective SPCBs.

Mechanisms will be evolved to reduce local concentration of pollutants in these problem areas. Strategies will be developed for areas with high pollution loads where the accumulative effect of the various types of pollutants would be taken into account including pollution of ground water. Existing units in these areas will be targeted for effective action. New units in these areas will be required to comply with location specific standards for stringent environmental quality objectives. These will include matching waste generators with waste buyers, with the objective of solving waste disposal.

Almost all the areas have been surveyed in detail to identify the sources of pollution and to chalk out a time-targetted action plan. **(Details in Annexure)**

The heavily polluting industries that have been identified in the action plan are as follows:-

Air Pollution Control
Cement, Thermal Power Plants, Iron & Steel, Fertilizer, Zinc Smelter, Copper Smelter, Aluminium Smelter, and Oil Refinery,

Water Pollution Control:
Distillery (i.e. Fermentation),Fertilizer, Pulp & Paper (Large & Small),Basic Drugs, Dyes & Dye intermediates, Pesticide Manufacturing, Oil Refinery, Petro-Chemicals, Tanneries, Sugar and Pharmaceuticals.

Ganga Action Plan

The Ganga Action Plan is one of the major national activities in the direction of not only prevention of pollution but also restoration of our resources. The river is being polluted by a number of sources like flow of sewage from cities and towns, discharge of industrial effluents, run-off from agricultural fields and other non-point sources like mass bathing, cattle washing, and defecation etc. making Ganga water unfit for drinking without treatment. The physico-chemical and bacteriological characteristics of Ganga water are monitored at 27 locations. Extensive efforts have already been made and considerable success has been achieved in restoring the water quality of the river Ganga. The efforts include control of pollution from major industries, diversion of sewage and construction of sewage treatment plants, electric crematoriums, public toilets etc. The actions taken in the area of industrial pollution control included identification of 68 major polluting industries along the river. There has been extensive follow-ups in implementing the provisions of the Pollution Control Acts in respect of these industries which has resulted into even closure of some of the polluting units. The pollution control status in these 68 industries is as follows:

Status	No. of industries in			Total
	UP	Bihar	WB	
ETP operating	23	4	16	43
ETP being constructed	03	0	05	08
No ETP at site	05	0	02	07
Unit closed/ lock-out	03	1	06	10
Total	34	5	29	68

Additional industries are being identified not only along the mainstream of the Ganga but also on its tributaries, and actions are being initiated to further control pollution of this river.

Under GAP, a total of 261 schemes have been sanctioned at a cost of Rs.347.22 crores. The schemes include interception, diversion and treatment of sewage, setting up of electric crematoria, low cost sanitation and river front facilities in the States of Uttar Pradesh, Bihar and West Bengal. The entire cost of the programme is being borne by Government of India.

External Assistance Received for Ganga Action.

S.No.	Source of Assistance	Amount	Remarks
1.	World Bank	SDR 25 mm (equivalent to Rs.60 crores)	For priority pollution control works in UP and West Bengal
2.	Royal Government of Netherlands	Dutch guilder 50 Million (equivalent to Rs.60 crores)	For Integrated Sanitation Projects at Kanpur and Mirzapur
3.	Overseas Development Administration Government of UK	Technical Assistance only	For providing technological and Scientific inputs under the Ganga Action Plan

National River Action Plan

A National River Action Plan for abatement of pollution in the polluted stretches of some major rivers identified on the basis of surveys by the Central Pollution Control Board is under formulation. Details in this regard are being worked out. The Action Plan, when approved, is proposed to be undertaken on sharing of cost between the Centre and States concerned on 50: 50 basis.

INTERNATIONAL COOPERATION

The Ministry is the nodal agency in the country for the United Nations Environment Programme (UNEP), South Asia Cooperative Environment Programme (SACEP), International Centre for Integrated Mountain Development (ICIMOD) and the International Union for Conservation of Nature and Natural Resources (IUCN). The Annual financial contributions are made to the above organisations and efforts are made through active participation to obtain adequate benefits from the above organisations. The Ministry also functions as the nodal agency for participation in international agreements such as the convention on International Trade in endangered species, the Convention of Migratory species, Ramsar Convention on Wetlands and the Basel Convention on Trans boundary movement of Hazardous substances. These International Conventions/ Agreements are being looked after by respective divisions. In addition, the Ministry is also dealing with Vienna Convention, the Montreal Protocol on the Substances that deplete the Ozone Layer and are participating in the Inter Governmental Negotiating Committees for Convention on Climate Change and Bio-diversity.

The Ministry and its agencies have undertaken projects in collaboration with the World Bank, Food and Agriculture Organisation (FAO), United Nations Development Programme (UNDP), World Health Organisation (WHO), European Economic Community (EEC), South Asian Association of Regional Cooperation (SAARC), UNEP, Canada, USA, Sweden, Norway, Denmark, U.K., Netherlands and Germany etc. All bilateral and multilateral agreements of cooperation and liasion with the donor agencies for securing information on areas of donor's interest and presenting project ideas for consideration by the donors are dealt with by the International Cooperation Division of the Ministry.

The details of various cooperation programmes are as follows:

Indo-Australia
A project on cleaning of Hussain Sagar Lake in Hyderabad is being supported.

Indo-ADB
Asian Development Bank (ADB) provided assistance for a project on "Review of Environmental Laws" in India. An agreement has been signed with the ADB for developing Environmentally Sound Coal Technology. Number of other projects are ongoing.

Indo-Canada
CIDA (Canadian International Development Agency) has agreed in principle to support the "Eco-development of Chilka Lake" project in Orissa. The detailed project is being formulated. In addition, cooperation with Canada in the areas of forestry, wildlife and conservation is also being sought for.

Indo-DANIDA
A project for Environmental Master Plan Study of South Kanara District of Karnataka is under consideration. DANIDA is also supporting a project on Environmentally Sound Development of three lake areas in Tamil Nadu. The Denmark Government has also been approached to strengthen the Tamil Nadu Pollution Control Board and take up the study of pollution in the Ooty Lake. The agreement on this with the Danish Government is under finalisation.

Indo-EEC

EEC and India have collaborated primarily in the area of pollution control. One Ambient Air Quality Monitoring Station in Delhi has been installed under EEC Cooperation. Efforts are now being made to seek cooperation with EEC in the areas of clean technology, waste minimisation and industrial pollution control with special reference to dye and chemical industries.

Indo-France

India and France signed an agreement to initiate cooperation in the environment sector in the year 1982. Clean technologies. technology transfer in sustainable development, waste-minimisation and environmental audit and water quality monitoring have been indicated as possible areas for cooperation. A formal proposal is being worked out for soliciting French Cooperation in these areas.

Indo-FRG

The Indo-German project started in 1985 with the aim of strengthening of laboratories and training of the staff of the CPCB and SPCBs. The project provides equipment for the laboratories, organises training courses, etc. Besides these, short-term consultancy covering 19 areas, such as laboratories management, analytical quality control, environmental impact assessment, environment planning etc., form part of the project. Phase I of the project ended in 1989. Currently Phase II is under implementation. In Phase II nine laboratories of the Central/ State Boards are being strengthened. These laboratories are of Bangalore, Baroda, Bhopal, Calcutta, Delhi, Gandhinagar, Guwahati, Jaipur and Patiala. It includes providing appropriate instruments and training upto 90 man-months. Other major projects are :

- Operation of automatic ambient air quality monitoring station and mobile units and stack monitoring in Delhi.
- Provision of advisory services and organisation of activities in the field of environmental planning.

Indo-Japan

During the Annual consultations, the Japan Government agreed to consider supporting establishment of a National Environmental Management and Training Centre in India. Further progress was made in respect of Japanese loan assistance for Yamuna Action Plan and Greening of Aravalli Hills.

Indo-Dutch

Under the Indo-Dutch programme assistance is provided for Ganga Action Plan for execution of schemes in Kanpur and Mirzapur, Conservation, Industrial Counselling and Institutional strengthening. The Dutch Govt. is also considering a number of new project ideas notably in the areas of Global Environmental Problems and Conservation, under their Spearhead Programme. Under Indo-Dutch bilateral cooperation programme basic training on sampling and analysis was provided under the project "Monitoring of river Yamuna". The following projects have also been agreed to.

- Strengthening of the Kerala Pollution Control Board,
- Control of pollution in small scale textile industry, and
- Pollution Control in Gujarat State Fertiliser Company.

Indo-Norway
Projects under Norwegian assistance in Orissa have been identified and are being formulated. The proposal for NORAD assistance to Disaster Management Institute in Bhopal is under active consideration. NORAD has also agreed to support the strengthening of G.B. Pant Himalayan Institute plans to takeup environmental projects in Karnataka, Rajasthan and Himachal Pradesh in addition to Orissa. Besides, projects on pollution monitoring from aluminium industry and dispersion modelling of air pollutants in five places viz. Delhi, Dhanbad, Chembur, Visakhapatnam and Talcher have been agreed under cooperation programme. The main objectives is to transfer expertise from Norway in the area of air quality modelling including training on models and the application of models to Scientists from CPCB and SPCBs of Andhra Pradesh, Orissa, Maharashtra and Bihar. The model development and the training programme has been designed and will be performed by the Norwegian Institute of Air Research.

Indo-Sweden
SIDA supported some seminars on Administrative Development in forestry sector. SIDA has also set up an Environmental Centre in Hyderabad. Another project on assistance to paper and pulp mills is under active consideration of the Swedish side.

Indo-UK
The British Government has offered assistance for a project on Environmental Forestry in Western Ghats (Karnataka). The ODA has also agreed to support environmental forestry projects in Himachal Pradesh and Uttar Pradesh as well as technical assistance in selected areas under Ganga Action Plan. The proposals for strengthening of ICFRE are being finalised.

Indo-US
The US Govt. has agreed to collaborate on projects in the areas of Biodiversity Conservation, Conservation of Wetlands, Mangroves, other Endangered Systems, Clean Technologies, Forestry Research and Education. A project related to public awareness in critically polluted areas was also agreed for funding and for which Dhanbad in Bihar has been selected as a study area.

World Bank
The Government of India has entered into an agreement with the World Bank in July 1991 on a project for "Industrial Pollution Control". The agreement includes a line of credit of US $ 155.6 million over a period of five years and an estimated amount of US $ 112 million approximately to be provided as counterpart funds by the Government of India, State Governments, individual industrial units availing the loans and financial institutions involved in the project. The activities under the project have commenced in November 1991 and are expected to be completed by the end of the Eighth Five Year Plan. The agencies responsible for implementation of project are: (i) MoE&F through the CPCB; (ii) IDBI (Industrial Development Bank of India; and (iii) ICICI (Industrial Credit and Investment Corporation of India). The latter two are financial institutions through which will disburse loans to industrial units.

The MoE&F has the overall responsibility for execution of the institutional development component for strengthening of the laboratory of SPCBs. The CPCB, in this agreement, is the procurement agency for equipment for the SPCBs and, the nodal organisation for implementing the training programme.

The main objectives of the project are:

- To strengthen the monitoring and enforcement abilities of the Pollution Control Boards of the heavily industralised States in the country, i.e. Gujarat, Maharashtra, Tamil Nadu and Uttar Pradesh;

- To get individual industrial units to install appropriate pollution control devices, with a focus on the chemical and related industries (This will include process modernisation for waste minimisation and resource recovery which has a positive impact on pollution reduction);

- To assist in the establishment of CETPs for clusters of small-scale industrial units; and

- To introduce clean technologies and thereby have minimum generation of wastes.

The MoE&F has constituted a Steering Committee for the implementation of the project at the national level. This committee is also formulating a Task Force for evaluation of proposals on demonstration projects and technical assistance studies, relating to promotion and development of cleaner technologies of industrial production. Action plan is prepared at CPCB to strengthen 36 laboratories of four SPCBs. The distribution is as below:

Name of Pollution Control Board	Central laboratory	Regional laboratories
Tamil Nadu Pollution Control Board	1	10
Uttar Pradesh Pollution Control Board	1	11
Gujarat Pollution Control Board	1	5
Maharashtra Pollution Control Board	1	4

Under Ganga Action Plan, three sewage treatment plants in UP and 12 Pumping Stations Schemes in West Bengal are being executed with World Bank Assistance. Forestry sector projects for Andhra Pradesh, Maharashtra, Madhya Pradesh and West Bengal are also under consideration of the World Bank.

Multilateral cooperation programmes

Number of externally aided afforestation and Wastelands Development Projects have been implemented in 11 States with assistance from donor Agencies like World Bank, SIDA, EEC, and Japan etc. Similarly two three Growers' Cooperative projects have been proposed for assistance by SIDA and CIDA.

Global Environmental Issues

UN Conference on Environment and Development (UNCED)

India was a member of the Inter-Governmental Preparatory Committee established by United Nations General Assembly.

India played an important role among the developing countries in putting forth their views and concerns in the preparatory process.

India also participated in the Ministerial Conference of selected developing countries on Environment and Development, organised by China at Beijing in June, 1991.

Climate Change

The Ministry is the nodal agency for the Inter-Governmental Panel on Climate Change (IPCC), jointly established by UNEP and WHO to study the causes and impacts of climate change and response strategies required to deal with these problems. Inter-Governmental negotiations on a Global Convention of Climate Change under the aegis of the UN General Assembly were recently held recently and India actively participated in the negotiations.

Bio-diversity Convention

As Nodal Agency for a Global Convention on the Conservation of Bio-diversity, India held wide scale consultations with Government agencies and experts to formulate Government's views on various aspects of the Convention and also participated actively in the on-going negotiations, under the aegis of UNEP.

Protection of the Ozone Layer

India participated actively in the Meetings of the parties to the Vienna Convention, the Meetings of the parties to the Montreal Protocol and in other meetings related to various aspects of the Montreal Protocol. The necessary approval of the concerned authorities was also obtained by the Ministry to accede to the Vienna Convention on the protection of the Ozone layer. This convention has come into force June, 1990. During the year, an exercise to draft a strategy for a reduction and eventual phase-out of Ozone depleting substances has been initiated.

Global Environment Facility

A Global Environment Facility (GEF) has been jointly established by the World Bank, UNDP and UNEP. The Ministry on behalf of the Government of India has been playing a coordinating role with regard to the same.

International Conventions

The Ministry continued to be actively involved with important International Conventions like the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES), the International Whaling Convention and the Convention on Conservation of Migratory Species.

Major constraints

The major reason for the poor environmental performance of industries has been the government's undue reliance on the conventional regulatory approach. In India, the weakest link in this mechanism has been the loose administrative arrangements for monitoring and enforcing environmental standards by the State Pollution Control Boards (SPCBs). The boards suffer from wants of funds, qualified staff and other facilities like assistance of consultants, laboratories, monitoring equipment etc. In view of the above, enforcement of the acts has been very poor. Other aspect is that our regulatory approach is not very comprehensive, is media specific, and hence less effective. There is therefore an urgent need to supplement the regulatory mechanism with the economic instruments which include pollution charges, subsidies, enforcement incentives, marketable permits and deposit/return schemes, etc. The major thrust of these instruments should be to develop cost effective technologies to reduce pollution and generate revenues to finance monitoring and enforcement. A recent example of the application of economic instruments is the increase in energy costs coupled with availability of low interest loans from financial institutions which has led to a large scale adoption of membrane technology in the manufacture of caustic soda.

Consultancy gaps

a) The country is unable to make reliable instruments for monitoring pollution due to waste water, solids/ semi-solids and air pollution. Automation in treatment facilities is practically lacking. Even reliable flow measuring instruments are not available. Ambient air quality monitoring by continuous and automatic gas analysers are, though made, not reliable.

b) Risk assessment, disaster management, hazard analysis (HAZAN) and hazard operation (HAZOP) studies are not reliably done for chemical and petrochemical industries, refineries, etc.

c) Standardisation of instruments and equipments is totally lacking.

d) Certain Hi-tech technology like activated carbon treatment of wastes, solid wastes from municipal authorities, noise pollution, CLEAN technologies are some of the areas in which the country has to depend upon foreign technology.

e) Professional training, recognised by Government/Statutory authorities for chemists, operators, technicians, managers, etc. is still not available. Such courses leading to certificates, diplomas should be started in the country.

Constraints

Reluctance of industries to adopt Hi-tech technologies, due to financial involvement. Pollution Control Boards do not insist on such technology, though of late, treatment like, incineration of hazardous and toxic waste is being insisted upon. Government has failed to give financial incentives to the industries for adopting Hi-tech technologies.

Major initiatives required

Integration of policy areas

Critical policy areas for control of pollution come under different departments and levels of Government. Sectoral Ministries, State Governments, local bodies and agencies responsible for planning and implementation of development projects will be required to integrate environmental concerns more effectively in all policy areas. Local authorities play a key role in abatement of pollution and environmental concerns need to be built into the way they operate. Steps will have to be taken to strengthen governmental and institutional structures dealing with environmental management, especially within the ministries dealing with the sectors of energy, industry, water resources, transport and agriculture and who would develop specific programmes in regard to pollution prevention.

Amendment in Institutional structure

Policy making, legislation and law enforcement influence each other. The increase in the number of regulations increase difficulties in enforcement. Legislation regulating particular activities will be amended to incorporate and eliminate clashes with environmental criteria. Traditional instruments for monitoring of compliance and investigation of offences are becoming over-burdened. An integrated overview and organisational structure for decentralised environment impact assessments and environmental law enforcement based on cooperation with local authorities will be sought.

Holistic approach for environmental management

While pollution from specific sources including towns and industries have been addressed, non-profit pollution from run-off of agricultural inputs such as pesticides, insecticides, fertilisers, etc. has not been dealt with. This is gaining increased proportions, which is polluting not only our water bodies but even sub-soil water resources and would affect the health of human beings. A long-term policy for pesticides use, including the introduction of environmentally acceptable pesticides, particularly biopesticides and non-persistent biodegradable ones, and integrated pest management together with the phasing out of the proven harmful toxic and persistent ones, would be formulated in collaboration with the concerned Ministries and infrastructure involved for its effective implementation. A similar policy for fertiliser use will also need to be formulated.

Training Need

Pollution control is an inter-disciplinary subject. Formal degrees are awarded by only some universities/institutions in environmental engineering/sciences. Graduates and post-graduates in the fields of Chemical/Civil engineering and sciences, have not had any formal training in the field of pollution prevention, abatement and control. When they are appointed in PCBs (or any other organisation working in the field of environmental management), they face a gigantic task before them. Therefore, it is necessary to have them trained and oriented for discharging their responsibilities smoothly and efficiently in different areas, such as, pollution of control technologies, consent management, implementation of effluent and emission standards, etc. In addition, there is a need to improve the capabilities of

persons already employed in PCBs. It is necessary that uniform methods of analysis of pollutants and consent granting are adopted and ensured through training for proper and effective implementation of the Acts. To summarise, training is needed in the following fields:

- Operation and maintenance of water and air pollution control treatment units/ devices;
- Management, routine operation and maintenance of environmental laboratories;
- Consent management including setting standards; and
- Specific subjects such as management of hazardous waste, modelling, data processing and legal aspects.

Coal resources

Table 1. Recoverable reserves of coal (million tonnes)

	Recoverable reserves as on 1.1.85	Depletion during 1985-97	Recoverable reserves as on 1.1.97	Projected production in 1996-97
Coking coal	8507	201	8306	39.0
Non-coking	60346	1397	58949	269.0
Total	68853	1598	67255	308.0

Organisation of coal industry

The coal mines were nationalised between 1971 and 1973 and the industry was re-organised in 1975 with the creation of Coal India Limited as a holding company. A number of subsidiary companies were formed based on geographical distribution. In the southern region, another Government company - Singareni Collieries Company Limited - continues to operate the mines in Godavari Valley Coalfield. The details of the major coalfields under each company is given below:

Table 2. Distribution of major coalfields in coal companies

Region	Company	State	Coalfield
Eastern .	ECL BCCL CCL MCL	West Bengal and Bihar Bihar, W.Bengal Bihar Orissa	Raniganj, Salanpur, Rajmahal, Santhal Parganas, Mugma. Jharia Ramgarh, Bokaro (E&W), Karanpura (N&S). Talcher, Ib Valley.
Western	NCL WCL SECL	M.P., U.P. Maharashtra, M.P. M.P.	Singrauli Wardha, Pench- Kanhan, Kampti Korba, CIC
Southern	SCCL	A.P.	Godavari
North-east	NEC	Assam, Meghalaya	Makum

Performance in the Seventh Plan

An analysis of the company-wise performance during the Seventh Plan for various items has been carried out and the observations are as follows:

1/ While the consumption of coal increased annually by 5.5 per cent during the Sixth Plan, the actual annual average growth rate in coal consumption during the Seventh Plan was 7.3 per cent.

2/ Power, iron and steel, cement sectors account for about 80 per cent of the total coal consumption. There is an increasing trend in the consumption of specific coal in the power sector due to drop in calorific value of coal supplies. The quality of coal supplies may not improve much as the share of underground mining is not likely to improve over the decade. Perhaps, one solution to this problem is to wash non-coking coal before supplying to power plants and other selected industries.

3/ The production in 1989-90 was about 201 mt and the actual growth rate achieved during the 7th Plan was 6.4 per cent per annum as against the planned growth rate of 8.9 per cent.

4/ While it was considered desirable to reduce pit head stocks, they increased unabated during the Seventh Plan. It increased from 30.4 mt (as on 1.4.85) to 37.4 mt (as on 31.3.90) and has further increased to 48.6 (as on 31.3.1992).

Areas of concern

The plan document has identified problem areas which would be dealt with during the Eighth Plan period. Some of these are as follows:

Ineffective demand-supply management: There were serious mismatches in the supply vis-a-vis demand throughout the 7th Plan period due to various constraints like shortfall in production from Singareni collieries deviations in the materialisation of both production and demand, etc.

2/ Delays in implementation of coal projects resulting in cost over-run.

3/ Problems of coal quality, especially for steel industry which resulted in increase of imported coking coal.

4/ High levels of pit head stock in certain coalfields, especially in Bihar and West Bengal.

5/ Environmental issues such as land degradation.

6/ Contribution of production from underground mines remains stagnant and was nearly 37 per cent of the total as against the plan target of 44 per cent.

7/ Availability of smokeless coal fuel for domestic use continued to remain at a marginal level throughout the Plan period. Availability, quality, pricing, and distribution problems have come in the way of promotion of these fuels in the domestic sector.

Eighth Plan

Demand : While consumption of raw coal increased annually at 7.3 per cent during the Seventh Plan, it is expected to grow at an annual rate of 6.3 per cent during the Eighth Plan. The overall demand for raw coal in 1996-97 (terminal year of the Eighth Plan) has been projected at 311 mt. The sectoral break-up is given in Table 3.

The power sector is the largest consumer of coal followed by steel and cement industries. For the major sectors (power, steel, cement) the demand is related to the sectoral targets of production, while for other industries category, in the absence of reliable data, the demand forecast is based on trend analysis.

Table 3. Sector-wise coal demand (million tonnes)

Sector	1989-90			Projection 1996-97
	VII Plan Target	Actual	1991-92 Actual	
1. Steel & coke ovens	41.10	28.37	31.66*	42.00
2. Steel (DR)	-	-	0.40	2.00
3. Power (utilities)	120.00 (9.00)	113.00 (2.12)	134.60 (2.30)	185.30 (4.70)
4. Railways	8.00	5.73	4.42	3.00
5. Cement	12.60	8.74	9.97**	17.50
6. Fertilisers	6.50	3.97	4.23	4.00
7. LTC/soft coke	5.00	1.30	0.99	4.00
8. Export	0.50	0.16	0.11	1.00
9. **Other industries**				
- Captive power	10.00			15.00 (2.10)
- Brick Kilns & others	29.00			33.20 (0.20)
- Sub-total (9)	39.00	34.55	38.50	48.20 (2.30)
10. Colliery consumption	4.00	3.97	4.06	4.00
Total	236.70 (9.00)	199.79 (2.12)	228.94 (2.30)	311.00 (7.00)

Note: 1. * including imported coal of 6.09 million tonnes.
2. Figures in bracket indicate washery middlings.
3. ** Excludes supply to cement plans from open market at the rate of 1.5 lakh tonnes per month.

Production **:** The raw coal production is projected as 308 mt in 1996-97 which implies an average annual growth rate of 6.1 per cent in the Eighth Plan as against 6.4 per cent achieved in the Seventh Plan. The details of contribution to production programme in 1996-97 of projects of different categories is given in Table 4.

Table 4. Contribution to production from projects in 1996-97 (mt)

Company	Existing mines and completed projects	Sanctioned ongoing projects	New projects	Total
Coal India Limited	121.03	121.13	27.84	270.00
Singareni	12.32	15.93	4.75	33.00
TISCO/IISCO/DVC	5.00	-	-	5.00
Total	**138.35**	**137.06**	**32.59**	**308.00**

The annual growth rate of coal production in the Eighth Plan will be somewhat high in the case of ECL, CCL, NCL & MCL and SCCL. A substantial part of the increase is expected to come from the on-going projects. New projects are expected to yield about 33 MT in the Eighth Plan, but this would depend on provision of adequate resources and timely execution of the projects. One of the major constraint would be acquisition of land for opencast mines which is becoming progressively more difficult to release land for coal mining. In Raniganj coalfield (ECL), the declining trend in production would be arrested and sharp increase in production is expected mainly from the ongoing projects in which construction work was started during Sixth and Seventh Plans. Similarly coalfields like North Karanpura, Ib Valley and Talcher are in a position to enhance production rapidly, provided adequate resources for infrastructure for evacuation of coal is made available.

The share of production from opencast mines is expected to increase from 63 per cent in 1989-90 to 67 per cent by 1996-97. However, it is desirable to maintain in the long run, a reasonable mix between opencast and underground mining, so as to keep the average cost of production of coal at an optimum level in the future.

One of the steps for a proper demand-supply management is to match the coalfield-wise production plans with the requirements of the consuming sector, both quantitatively and qualitatively, with adequate evacuation facilities. The development of coalfields like Talcher, Ib Valley, North Karanpura, Singrauli, and Wardha should be given priority. The production plan of selected coalfields is given in Annexure - 3.1.

Iron and Steel sector: Coking coal availability and washed coal production plan

At the beginning of the Seventh Plan, there were twelve prime coking coal washeries with a capacity of 17.4 MT (in terms of raw coal input) and nine medium coking coal washeries with a capacity of 15.7 MT. Two washeries with capacity of 5.1 MT were to be added during the Seventh Plan, but are now likely to be commissioned only in the Eighth Plan. Shortage of acceptable coking coal for steel plant and the problem of washeries performance affected coking coal availability resulting in import of 6-7 MT of low ash coking coal in 1990-91 and 1991-92. The performance of washeries has been affected due

to age of plants, lack of modernisation and deterioration in the quality of raw coal feed. However, modernisation/upgradation plans have been drawn up for the washeries and these are likely to be completed in the Eighth Plan. A few new washeries for medium coking coal are being planned. The actual supplies in 1991-92 and the production plan for 1996-97 are given in Table 5.

Table 5. Supply of coking coal to steel plants (million tonnes)

Category	1989-90	1991-92	1996-97 (Projections)
Prime coking	5.42	5.54	7.90
Medium coking	5.84	6.16	7.65
Blendable coal	0.46	0.88	0.85
Total	11.72	12.58	16.40

In the steel sector, in view of the inadequate supply of indigenous coking coal (both quality-wise and quantity-wise), import of coking coal would continue. Eighth Plan document has projected an import of only 3 MT of coking coal in 1996-97 as against 6-7 MT at present. Reduced imports are based on increase in washery yield from existing coking coal washeries and commissioning of a few new coal washeries in the Eighth Plan, namely Madhuband (Prime coking coal), Kedla (Medium coking coal).

Pit-head coal stocks

Coal stocks at pit-head increased in all the plan periods which is considered wasteful, blocking scarce resources. In order to ensure that pit-head coal stocks are reduced to a reasonable level, some action is required in the following areas:

- increase in coal production only from areas having adequate rail links,
- increase in coastal movement,
- increase in captive transport network (MGR system), and
- ensure uniform despatches throughout the year as far as possible.

Coal quality

Eighth Plan has identified the following areas for action:

- reducing ash content in coking coal supplies to steel plants through technology upgradation in washeries.
- Beneficiation of non-coking coal (in selected cases) for supplies to power plants.
- All coal to pass through coal handling plants.

Plan outlay

Keeping in view the increase in demand for coal and lignite and anticipated production requirements during the Eighth Plan, the Planning Commission has approved an investment of Rs.10,507 crores, the break-up of which is as follows:

Table 6. Investment plan for coal and lignite sector (Rs. crores)

	VIII plan	VIII plan
Total investment	**10,507**	**7,159**
Coal India	8,520	5,531
Singareni	1,000	654
NLC (Mining)	800	938
Science and Technology	87	36
Exploration	25	|
subsidence control	75	NIL

The programmes of Science and Techonology, regional exploration and environmental measures and subsidence control would continue to require budgetary support throughout the Eighth Plan. The financing pattern would work out as follows:

IEBR	-	Rs.7907 crores
Budgetary support (including foreign credit)	-	Rs.2600 crores
Total	-	**Rs.10507 crores**

In the Sixth Plan period, the investment in CIL was Rs.3259 crores and this was financed entirely from the budgetary support. During the Seventh Plan period, investment in CIL companies was Rs.5531 crores. This investment was financed from the following sources:

	Rupees
Budgetary support from Government	4903 crores
Bonds/intercorporate loan	300 crores
Internal resources	274 crores
Direct foreign credit	54 crores

It can be observed that in the Seventh Plan, 88 per cent of the plan expenditure was financed from budgetary support. In the Eighth Plan, budgetary support is much lower at 19 per cent and the debt servicing operations to the Government would increase steeply.

This would mean that the provision made in the coal price for depreciation, interest and return on equity should be adequate to meet the need for resources. Secondly, the cost of production of coal has to be contained through improvement in efficiency of operations.

Non-coking coal beneficiation

As a first step, one washery in the non-coking coal sector was sanctioned in the Seventh Plan with a capacity of 6 MT and is expected to be commissioned in the Eighth Plan. The Government has, in principle, agreed to beneficiate non-coking coals in certain coalfields (eg. Talcher) at the pit head for supplying to long distance power stations. Two washeries with a total capacity of about 5 MT have been sanctioned in Talcher coalfield and may be commissioned by the end of the Eighth Plan. Availability of resources for washeries may prove to be a constraint. There are definite environmental and economic benefits in supply of beneficiated coal to power plants and other selective customers like cement and sponge iron industries.

Environmental implications of coal mining

The major environmental impacts of coal mining and associated activities are degradation of valuable agriculture and forest land and displacement of population. The Eighth Plan envisages a major thrust in environmental management in coal mining areas. These are:

1/ Concurrent restoration of land in ongoing and new projects.
2/ Restoration of land and implementation of environmental safeguards in the old worked out areas, especially in Jharia and Raniganj coalfields.

A separate plan allocation for environmental control measures and subsidence control has been provided in the Eighth Plan. The provision is, however, too low considering the needs. In fact, an Expert Committee on restoration of abandoned mining areas has estimated a minimum investment of Rs.118 crores in 1987.

A programme for implementation of measures for abandoned mining areas is of great importance for conservation of coal resources, safety of local population and general improvement of the environment. The thrust areas are:

1/ control of land subsidence in old worked out areas of West Bengal and Bihar;
2/ control of fires in Jharia;
3/ restoration of damaged land.

In the report submitted in January 1993, a brief note on environmental impacts of coal mining was included. Perhaps the most serious impact of mining operations is on the land. The extent of land degradation, however, varies and is influenced by topography of the area, geology, nature of soil and method of mining. There has been a spurt in coal production after nationalisation, due to opening up of a large number of opencast mines. It is also evident that a number of new coal projects would have to be commissioned to meet the demand of coal in 8th and 9th Plans. Also due to past mining operations especially in Jharia and Rainganj coalfields large quantities of land have been affected. Details are as under:

Table 7. Land degradation in mining areas (in hectares)				
	Raniganj	Jharia	Others	Total
Subsidence areas due to past mining	5094	3497	526	9117
Abandoned areas	-	1268	3632	4900
External reject dumps	370	631	100	1101
Fire area	600	1732	-	2332
TOTAL	6064	7128	4258	17450

Opencast mining pollutes the environment much more severely than underground mining. Moreover, in many coalfields, forest land is required for mining (especially opencast mines). The requirement of land for mining projects during the 8th Plan has been estimated at about 98000 ha of which 24000 ha is forest land. The company-wise details are as follows:

Table 8. Company-wise land requirement for mining during 8th Plan (in hectares)			
Name of the company	Land requirement		
	Forest	Non-forest	Total
ECL	948	14268	15216
BCCL	7	1944	1951
CCL	4251	10361	14612
NCL	5963	9695	15658
WCL	616	5865	6481
SECL	8552	31537	40089
NEC	921	102	1023
CIL	21258	73772	95030
SCCL	2767	861	3628
Total	**24025**	**74633**	**98658**

Environmental Cost Analysis

Environmental control measures need sufficient funds and efforts to ensure adequate and permanent environmental improvements. The cost of environmental control measures is generally an integral part of the project costs. In 1992, TERI has carried out a study to assess the environmental cost in coal mining. The costs were grouped under five major heads as follows: The costs reflect only the direct control measures.

- Cost of rehabilitation of people.
- Cost of compensatory afforestation (for forest land acquired)
- Cost of land reclamation which includes technical and biological reclamation.
- Cost of anti-pollution measures for control of air, water, noise pollution.
- Cost of other provisions like preparation of report, R & D expenditure, etc.

The costs were calculated separately for a sample of opencast and underground mines and finally an average cost for the industry was estimated. A number of assumptions have been made in the cost analysis. The sample included 16 opencast mines and 8 underground mines from different coalfields. The results are as follows:

Table 9. Environmental cost in coal mines

Mining Technology	No. of mines in sample	Environmental cost (Financial) Rs./Tonne
Opencast mines	16	12.57
Underground mines	8	11.37
Average overall environmental cost	24	12.29

Annexure : Production plan of major coalfields (million tonnes).

/

PRODUCTION					
Coalfield	**1984-85**	**1989-90**	**1991-92**	**1996-97 (Projection)**	**Quality**
Raniganj	17.45	NA	15.5	25.1	NC Sup.
Rajmahal	0.80	1.2	4.2	10.5	NC Inf.
Jharia (BCCL)	21.8	26.6	27.0	32.0	C Prime NC Inf.
Bokaro (E&W)	13.0	14.0	15.8	18.8	C Medium
S. Karanpura	5.8	5.5	5.4	8.5	NC Sup.
N. Karanpura	4.7	5.9	7.0	14.7	NC Inf.
Singrauli	10.7	23.3	30.9	39.0	NC Inf.
CIC and Korba	27.4	38.5	44.2	45.5	NC Sup.
Ib Valley	2.0	5.2	6.9	12.9	NC Inf.
Talcher	3.4	8.0	13.8	25.6	NC Inf.
Wardha	7.2	12.5	14.5	18.7	NC Sup. NC Inf.
Singareni	12.3	17.8	20.6	33.0	NC Inf.

Power sector

Demand - supply projections in the Eighth Plan

Reliable and adequate supply of electricity will be of critical importance for effective implementation of the various development programmes in agriculture, industry and other sectors of the economy. With increasing economic activity and development of both rural and urban loads throughout the country, the demand for electricity will continue to rise rapidly during the next decade and thereafter. The major task during the Eighth Plan will, therefore, be to ensure that the anticipated demands are met adequately and in a reliable and cost-effective manner. The Eighth Plan will also have to provide for advance action on a number of new hydel projects so that the declining trend in the share of hydel generation in the total generation capacity in the country may be reversed and a reasonable hydel share ensured at least by the end of the Ninth Plan. Another important issue that Eighth Plan will be addressing is the environmental management of thermal, hydro and nuclear power plants of existing as well as new plants.

The Eighth Plan lays emphasis on improvements in the operation of the existing thermal generation units and other plant and equipment, reduction in the technical losses of the power system, improvement in the financial performance of the Central and State electricity undertakings and expeditious project implementation to minimise time and cost overruns. The Eighth Plan will place considerable emphasis on improving the reliability of power supplies to consumers in different parts of the country and promote access to the benefits of electricity in the rural areas, especially for agricultural consumers. During the Eighth Plan, advance action will be initiated on a sufficient number of new hydel projects to ensure that the share of hydel generation in the total installed generation capacity reaches a level of around 40 % by the end of the Ninth Plan. Table 1 gives peak load, energy availability and energy requirement in 1996-97 as per the 14th EPS.

Table 1: Demand for power in 1996-97 as per 14th EPS

Region	Peak load (MW)	Energy availability (MkWh)	Energy requirement (MkWh)	Surplus/ Deficit (%)
Northern	24234	124424	129587	-4.0
Western	19587	117108	121159	-3.3
Southern	18150	90335	103191	-12.5
Eastern	10254	64417	56011	+15.0
North-Eastern	1388	10132	6169	+64.2
Andaman & Nicobar Islands, Lakshadweep	43	100	157	-40.7
All India	**73656**	**406516**	**416274**	**-2.3**

Capacity additions required during the Eighth Plan

The sectoral demand estimates of the Planning Commission indicate a consumption requirement of 308,840 Mkwh from the utilities in 1996-97, after suitable adjustment for energy conservation measures during the Plan period. This implies a gross generation requirement of 433,610 Mkwh after taking into account the system and auxiliary losses of the order of 23 per cent and 7.5 per cent respectively as obtained during 1991-92.

The rate of capacity utilization, for the total installed generation capacity in position, realised in 1991-92 was 4160 kWh/kW. If this rate of utilization of capacity is maintained during the Eighth Plan, the installed capacity requirement in 1996-97 works out to nearly 1,04,235 MW during the Eighth Plan period. This requires a capacity addition of about 35153 MW during the Eighth Plan period.

Keeping in view the status of the ongoing, sanctioned and new projects in the pipeline, it is assessed that a capacity addition of the order of 30,538 MW would be feasible during the plan period as per the details indicated in Table 2.

Table 2: Benefits From Sanctioned, CEA Cleared and new schemes during Eighth Plan (MW)			
Source	Ongoing/ sanctioned schemes	CEA Cleared/New Schemes	Total
Hydro	9131	151 .	9282
Thermal	15395	4761	20165
Nuclear	1100	-	1100
Total	25626	4912	305338

The capacity additions indicated above will, however, be contingent upon fuel linkages being firmed up and early start of work being taken up on new projects. Based on this, the cumulative generation capacity by the end of 1996-97 will be as shown in Table 3.

Out of the total addition of 30538 MW during the Plan period, 12,838 MW will be added in the Central Sector bringing the share of the Central Sector to nearly 32% in the total installed capacity by 1996-97. In the State sector, capacity addition during the Eighth Plan is envisaged to be 17,680 MW. This includes a capacity of 2,810 MW in the private sector for which no public sector outlay is provided.

Table 3: Generating Capacity Anticipated at the end of the Eighth Plan (MW)				
	Hydro	Thermal	Nuclear	Total
Capacity as on 31.3.1992	19189	48108	1785	69082
Additions during Eighth Plan	9282	20156	1100	30538
Total Capacity on 31.3.1997.	28471	68264	2885	99620

Table 3 shows that the share of hydel capacity in the total capacity in the country will marginally increase from 27.8% at the beginning of Eighth Plan to 28.6% at the end of the Eight Plan. This implies a reversal in the trend observed till now of a declining hydel share. It will be necessary to ensure that the targeted hydel capacity is fully achieved by making special efforts during the Eight Plan. These efforts should be supplemented by accelerating the development of hydel capacity additions in order to achieve the goal of increasing the share of hydel capacity to 40% by the end of the Ninth Plan as envisaged in the Directional Paper for the Eighth Plan.

It may be seen that there is a gap of 4,615 MW between the installed generating capacity requirement of 1,04,235 MW and the feasible cumulative capacity of 99,620 MW likely to be available by the end of the Plan. The gaps should be bridged largely through efficiency improvements and demand management. The average thermal Plant Load Factor (PLF) in the country has already shown an improvement. With the increasing share of more modern

and larger size generation units in the power system and continuing emphasis on R&M works, it should be feasible to enhance the level of utilization of the generation capacity by about 5% during the Eighth Plan. Similarly, with emphasis on system improvement schemes being taken up in rural and urban areas and an overall improvement in the load density in different parts of the country, a reduction of 2-3% in the average T&D losses at the national level should also be feasible. These improvements, taken together, will have the effect of saving about 3000 MW equivalent of new capacity additions during the Plan period, thereby reducing the gap to about 1615 MW. The endeavor should be to bridge this gap to the extent feasible, through appropriate measures of energy conservation and demand management and balance through additional capacity to be set up in the private sector, as presently envisaged by the Government.

Strategies identified in the Eighth Five Year Plan:

Private sector participation:

The government has recently announced major changes in policy expected to promote private sector participation in power development in the coming years. It is expected that about 3,000 MW of additional capacity will materialise over and above during the Plan period. This will supplement the capacity additions in the public sector.

Renovation and modernisation programme:

The R&M programme for rehabilitating the ageing thermal and hydel units initiated in the Seventh Plan will be enlarged in its scope to cover T&D systems and will be pursued further during the Eighth Plan. This programme is expected to be implemented within the first 2-3 years of the Plan period for yielding early benefits. While the CEA and Ministry of Power will provide the necessary technical and administrative support, the Power Finance Corporation (PFC) is expected to play an important role in financing the Programme.

Within the existing 120 hydro power stations under operation in the country with a total installed capacity of 15,200 MW, 49 power stations of a capacity of 8,834 MW have been identified for coverage under R&M to yield an additional peaking capacity of 500 MW and energy generation of 300 Mkwh annually.

Integrated operation of the regional power systems:

The country is at present facing a peaking shortage of the order of 20% which is likely to persist till such time that adequate capacity can be added for meeting the rapid growth in demand for electricity. In a regime of shortages, proper grid management becomes vital. There is urgent need for agreement among the constituent members of each region for observing grid discipline while managing the load in their respective systems to facilitate integrated operation of the rational power systems. This can be achieved through financial incentives including a two-part time-of-day tariff system. Appropriate price policy can also play an important role in levelling of peak demand.

The National Power Grid is expected to pave the way for integrated operation of the entire country's power system network, considered so essential from the point of view of optimum development and utilization of unevenly distributed energy resources obtaining in the country, exchange of power between the various states and regions transcending state/ regional boundaries thereby ensuring economy, reliability and security of power supply throughout the country.

Reduction in T&D losses

The distribution systems in the country are overloaded and are quite inadequate to handle the increasing load demands. The quality of power supply to the consumers has been far from satisfactory and the T&D losses have been on the increase. The T&D losses comprise of two components:

a) Technical losses;
b) Losses due to theft and other factors unaccounted for.

Various steps were initiated during the Seventh Plan to reduce T&D losses. Theft of energy was made a cognizable offence under the Indian Electricity Act, 1910 which provided for stringent punishment of all offenders. The Ministry of Power had introduced in 1989 an incentive scheme for the reduction of T&D losses. Upgradation and revamping of urban distribution systems and system improvement schemes in the rural areas had been undertaken for major urban centre with financial support of Power Finance Corporation and Rural Electrification Corporation. The Eighth Plan programme will comprise specific schemes taken up in this direction on a much larger scale. The average T&D losses at the national level remained at 22-23% during the Seventh Plan. Appropriate measures will be initiated during the Eighth Plan to reduce the losses progressively to 15% by the end of the Ninth Plan.

Improvement of financial performance of electricity utilities

It is imperative that the utilities generate adequate resources internally to be able to fully cover the fixed and operating costs including interest and other liabilities and have adequate surplus for funding their future expansion programmes. Apart from the rate of return and profitability, many electricity undertakings are facing liquidity problems as a result of their inability to recover dues from consumers. In many SEBs, the level of outstandings has already reached alarming proportions. In turn, these undertakings have also been defaulting on payments to be made to Central undertakings like CIL, NTPC, NHPC, BHEL etc, from whom they purchase coal, electricity and power equipment.

Project implementation

Even though there was a significant improvement in the rate of capacity addition during the Seventh Plan, there had been appreciable delays in project implementation and consequent cost overruns in both the Central and the State sectors. This is a matter of concern especially in view of the large capacity additions contemplated in the future and the need to optimise the use of scarce resources.

In the case of externally aided projects, the adverse economic implications of project delays are much more serious. The factors responsible for these delays are many and have already been discussed earlier. Some of these factors are outside the control of the utilities themselves. During the Eighth Plan, utmost priority should be given to the streamlining of the project clearance and approval procedures at both the Central and the State levels. A system of delegation of administrative and financial powers should be evolved at various levels to rationalise and streamline the procedures. It is also necessary to ensure that all ongoing projects are fully funded and provided timely financing by the concerned authorities. the extent to which the utilities can improve their internal resource generation will contribute to easing of the problem of timely funding of projects. This is a vital requirement for speedy project implementation during the Eighth Plan.

Small hydel units

The potential for small hydels is reported to be about 5,000 MW, against which the installed capacity was only about 220 MW at the end of Seventh plan. The projects likely to yield benefits during the Eighth Plan would contribute about 150 MW of capacity. Several schemes are under investigation and assistance needs to be provided to the States to expedite investigation work so that work on as many small hydel units as possible can be initiated at the earliest. However, these projects have taken longer to commission than expected resulting in cost over-runs. The reasons for this need to be analyzed and corrective steps taken.

Captive power generation

During the Seventh plan, the captive power generation capacity increased from 5,120 MW to about 6,487 MW. The generation actually increased from 12.35 Bkwh to 20.80 Bkwh during the Seventh Plan representing an increase of 68.42 percent. By the end of 1990-91, electricity generation from captive units reached a level of 24.1 Bkwh.

Technology

Considering the large additions envisaged in respect of the generation and transmission capacity of the power system, there is need for upgrading relevant technologies. The Department of Power has already initiated the necessary technical work in this regard. The work on finalisation of parameters of transmission line equipment and materials needs to be expedited. The on-going HVDC transmission works involve imported technical know-how. It is necessary to develop a strong indigenous technological base in this area. The first phase of Lower Sileru-Barsoor HVDC line as part of the National HVDC Project has since been commissioned. It is necessary to bring it to full load commercial operation quickly and expedite the work of the section phase so that the process of indigenisation of this technology may be quickened.

Plan outlay

Keeping in view the priorities for the Eighth Plan as indicated above, the outlays for the power sector for the Eighth Plan are given in Table 4.

Table 4. Outlay for power sector (Rs. crores)

	States	UTS	Centre	Total
Generation	24732.78	354.24	24337.13	49424.15
Transmission & Distribution	16782.41	1061.53	4436.81	22280.75
Rural Electrification	4000.00	-	-	4000.00
Renovation & Modernisation	1225.74	13.40	537.30	1776.44
Miscellaneous	220.93	16.71	1870.34	2107.98
Total	46961.86	1445.88	31181.58	79589.32

The Central sector outlay of Rs.31,181.58 crores includes outlays for the power programme of Neyveli Lignite Corporation and Nuclear Power Corporation. The outlay for rural electrification is included in the States/UTs outlay.

The financial outlays provided now for the Plan programme for the power sector fully cover the requirements of all ongoing schemes which will yield benefits of 24,316 MW capacity during the Eighth Plan. In addition, these outlays are expected to take care of a major portion of requirements of new generation schemes which are expected to yield additional capacity benefits of 3,412 MW (151 MW of hydro, and 2,261 MW of thermal). In order to achieve the targeted hydel share of 40% in the total installed generation capacity by the end of the Ninth Plan, it is recognised that advance action needs to be initiated during the Eighth Plan itself on a number of new hydel projects with a total capacity of at least 15,000 MW. The additional funds required for these projects will have to be found as and when these projects are ready for implementation. Such requirements of resources will have to be met from the internal generation of surplus within the power sector itself through technical improvements and rationalisation of tariff structure.

While the need for a progressive step-up in the share of hydel capacity in the total generation capacity in the country is well recognised, the consideration of environmental and other related problems associated with large storage reservoirs would require careful examination of choice of options for peaking support. The comparative economics of hydel plants and open cycle units based on liquid and gaseous hydrocarbons for meeting the peak and the intermediate load demand and the indigenous availability of both natural gas and oil will have to be given due consideration in actual policy formulation or project level decision.

Environmental management

In recent years, issues relevant to the adverse environmental impact of power projects have assumed considerable importance and have been a subject of public debate. The Eighth Plan will address itself to these issues directly and provide necessary safeguards so that environmental safety and stability may be ensured in implementing power projects in the future. Table 5 shows the present emission levels and emission levels in 1996-97. Emission levels has been estimated with the help of energy availability and pollutant concentration per kWh.

Table 5: Emissions of CO_2, SO_2, NOx and from thermal power generation in India: million tonnes		
Pollutant	**1990-91**	**1996-97**
CO_2	174	244
SO_2	1.25	1.76
NO_x	0.75	1.05

Specific targets to reduce pollution levels from thermal power generation in the eighth plan:

i) As the CO_2 levels are directly related to coal consumption in the thermal power stations, improving the efficiency of the thermal power station which means reduction of coal consumption hence reduction in pollution levels is the main target of eighth plan.
ii) With the objective of reduction of coal, new thermal power stations are to be designed for higher efficiency.
iii) To reduce pollution concentration levels around the load station centre, usage of beneficiated coal in the load centre station is recommended in the eighth plan.
iv) Efforts will be made in the eighth plan to augment hydel share in hydro-thermal mix.
v) On long term target, it has been decided that 15 years from now higher efficiency technologies such as IGCC, coal gasification will be adopted for thermal power generation.

Although hydro power doesn't emit any pollutant gases, it too creates certain environmental concerns such as soil erosion, submergence, deforestation, displacement of people etc..

A comprehensive policy is being evolved for the rehabilitation of families displaced by power projects. The Eighth Plan will place considerable emphasis on implementing such a policy. Special importance will be accorded to programmes aimed at catchment area treatment in the case of all major hydroelectric projects so as to contain the process of environmental degradation that has already taken a severe toll in many parts of the country. In the case of thermal power projects, in addition to installing facilities to restrict pollution to reasonable levels, special steps will be taken to reduce ash pollution by setting up facilities to convert fly ash into fly ash bricks to replace conventional clay based building material. Steps will also be taken to promote other uses of fly ash so as to convert this waste into a useful product, and at the same time, reduce the environmental degradation near the generating units. High priority will also be given to enforcing rigorous safety standards in the case of all nuclear power projects.

Annexure

Problem areas (HOT SPOTS) identified by Ministry of Environment and Forests and Central Pollution Control Board.

The critical areas have been identified as follows:-

1. Vapi, Gujarat
2. Chembur, Maharashtra
3. Vishakhapatnam, Andhra Pradesh
4. Talchar, Orissa
5. Manali & North Arcot, Tamil Nadu
6. Udyogmandal, Kerela
7. Pali, Rajasthan
8. Dhanbad, Bihar
9. Gobindgarh, Punjab
10. Korba, Madhya Pradesh
11. Singrauli, Uttar Pradesh
12. Digboi, Assam
13. Mangalore, Karnataka
14. Durgapur & Howrah, West Bengal

Details of some of the problem areas

North Arcot:

- The pollution generated by various tanneries in the district is very severe and it is observed that the river Palar and groundwater are polluted.
- CETP at Vaniyambadi, though constructed, is yet to be commissioned.
- Proper use of effluents and actual sites for disposal of the treated effluents have not yet been identified.
- At none of the places, the land required for disposal of the toxic sludge has been identified.
- The unlined oxidation ponds situated in SIPCOT, Ranipet, to discharge industrial effluents into, are posing threat because of percolation of pollutants to the groundwater. During the monsoon, the overflow from these ponds join the nearby natural streams.
- Some of the industries have improper pre-treatment facilities.
- M/s Tamil Nadu Chromates and Chemicals Limited are generating about 25 tonnes of solid waste containing 12.6% of total chromium which is dumped inside the factory premises.
- Groundwater around SIPCOT, Ranipet industrial area, has shown excess chromium.
- No significant air pollution is observed.

Pollution loads generated by cluster of tanneries in North Arcot district are as follows:

Location	BOD (kg/day)	COD (kg/day)	SS (kg/day)
SIPCOT, Ranipet	2,326	10,764	1,930
SIDCO, Ranipet	4,285		4,108
Vaniyambadi	10,330		5,680
Ambur	6,039		5,600
V.Kota Road	4,390		4,157
Bakkalapalli	1,656		1,569

Bhadravathi

- Visveswaraya Iron & Steel Ltd (VISL) is one of major air polluting industries at Bhadravathi. The air pollution control equipment provided by VISL are inadequate.

- The treated effluent discharged by M/s Mysore Paper Mill (MPM) does not meet the standards stipulated by Karnataka Board. The available treatment facilities are inadequate. High concentration of SPM, SO_2 are observed through coal-fired boilers and new soda recovery plant boiler.

- The domestic effluents, generated from Bhadravathi, old and new towns, and industrial townships are also significantly contributing the pollution load to the river Bhadra.

- The ambient air quality in residential areas is causing serious problems to the residents of Bhadravathi. Air pollution loads generated at Bhadravathi are as follows:

Parameter	Pollution load (kg/day)
SPM	40,600
SO_2	12,430
NO_x	126

- The Bhadra river water is unfit for human consumption upto 20 km downstream of Bhadravathi. Water pollution load generated at Bhadravathi are as follows:

Parameter	Pollution load (kg/day)
SS	3,600
BOD	31,400
COD	36,000

Parwanoo

- Except HPMC, all water polluting industries have provided effluent treatment plants.
- Domestic effluent and HPMC untreated effluents contribute maximum SS, BOD and COD loads into Sukhana Nalla and domestic effluent alone in the Kaushalya river.
- Septic tanks provided by Housing Board for the treatment of domestic wastewater are not functioning properly.
- The quality of raw water of Kalka Railway water supply scheme and three municipal well supplying water to Kalka town, conform to Indian Standards (IS: 105000 - 1983).
- The Kaushalya river water quality conforms to A-Class per Central Pollution Control Board's designated-best-use concept for surface water.
- There is no significant air pollution problem in Parwanoo town.

Kala Amb

Water pollution load generated at Kala Amb are:

Parameter	Pollution load (kg/day)
BOD	1,770
COD	6,568
SS	4,764

- Pulp and paper units are the only sources of water pollution in Kala Amb and are creating all the water pollution problems, and contribution due to other industries or sources is insignificant. Kala Amb is situated entirely in the rural area and there is no urban pollution. The industrial estate is surrounded by small villages and as such there is no urban domestic wastewater water pollution.
- All the three paper mills have got ETPs, but the operation and maintenance is not proper.
- The entire wastewater generated at Kala Amb is joining the Markanda river through Jatanwalla nalla. There is no dilution water available either in Jatanwalla nalla and the Markanda river except during monsoon season.
- There is no significant air pollution problem caused either by industries or vehicles.

Annexure

i) Oil Refinery

- Total No. of oil refineries in the country : 12
- No. of units complying with both MINAS and emission standards : 6
- No. of units not complying with MINAS : 6
- No. of units complying with emission standards : 8

ii) Fertiliser Industry

Fertiliser industry	Straight Nitrogenous Fertiliser	Complex Fertiliser	Single Super Phosphate	Total
No. of industries	30	16	64	110
No. of units complying with both MINAS and emission standards	15	9	17	41
No. of units complying with MINAS	15	12	24	51
No. of units complying with emission standards	17	10(1*)	22(5**)	49(6**)
No. of units for which information not available	6	2	30	38
No. of units closed down/ shut down	2	-	-	2
No. of units where control systems are under installation	3	-	2	5

* SSI units which are not sending any information excluded
** Units not complying with fluoride emission standards.

iii) Thermal Power Plants

Implementation of standards was coordinated through SPCBs and National Task Forces. The information regarding air and water pollution were collected from all the thermal power plants (TPP) through quenstionnaire survey. The status of pollution control implementation in thermal power plants as on March 31, 1992 is as follows:

A: Status of air pollution control implementation

i) No. of TPPs complying with standards : 25

ii) No. of TPPs which have provided control equipment but their present levels of emission need to be checked for taking necessary measures : 16

iii) No. of TPPs which have provided timebound programme to meet standards :17

a) by 1992 : 01
b) by 1993 : 08
c) by 1994 : 08

iv) No. of TPPs not complying with standards and retrofitting/ installation of new ESPs will be covered under R&M scheme-II of CEA which is expected to be completed by the end of the VIIIth plan : 10

v) No. of TPPs closed : 02

B. Status of water pollution control implementation

Out of 70 TPPs, 33 are complying with the standards for ash pond effluents, 35 are under implementation of standards, and remaining two are closed.

iv) Non-ferrous Industries

The implementation of standards has been initiated, in non-ferrous industries such as copper, zinc, lead and aluminium through a National Task Force. The status of pollution control in these has been prepared on the basis of visits and questionnaire survey. The industry-wise status is as follows:

a) ***Copper smelters:*** There are two copper smelters in India located at khetri (Rajasthan) and Ghatsila (Bihar) of M/s Hindustan Copper Limited. None of the plants is complying with standards. Both the plants have been asked to expedite the work of implementation so that standards must be complied by December 31, 1993.

b) ***Zinc smelters:*** There are four smelters located at Debari, Chanderia (Rajasthan), and Visakhapatnam (Andhra Pradesh) of M/s HZL and Binani Zinc Limited of M/s Cominco Binani Limited located at Binanipuram (Kerala). Plant at Debari is complying with effluent and emission standards except SO_2 standards at H_2SO_4 plant.

c) ***Lead smelters:*** M/s HZL has two lead smelters alongwith their zinc smelters at Visakhapatnam and Chanderia and one exclusive lead plant at Tundoo (Bihar). Plant at Chanderia is complying with the standards while Visakhapatnam and Tundoo plants are not complying. These plants have been asked to comply the same by December 31, 1993.

v) Integrated Iron and Steel

Central Board conducted environmental auditing in 3 out of 7 plants, carried out persuasions for the implementations of control measures and issued directions to all the steel plants except Visakhapatnam steel plant which is yet to operate at full-scale. The pollution control status in seven integrated iron and steel is as below:

Steel plants	BSSL, Bokaro	BSP, Bhilai	ESP, Durgapur	RSP, Rourkela	IISCO, Burnpur	TISCO, Jamshedpur	VIN, Visakhapatnam
Status effluent treatment plant installation	P	P	P	P	P	C	C
Compliance with effluent standards	C*	P	P	P	P	P**	P**
Installation of air pollution control equipment	P	P+	P+	P+	P+	P	P***
Compliance with emission standards	P	P	P	P	NC	P	P
Installation of laboratory facilities and environmental division	Y	Y	Y	Y	P	Y	P

P-Partial, C-Complete, Y-Yes, NC-Non-compliance, * by dilution, ** under full-scale commissioning, *** under stabilisation with full capacity, + modernisation.

Other issues

Biodiversity

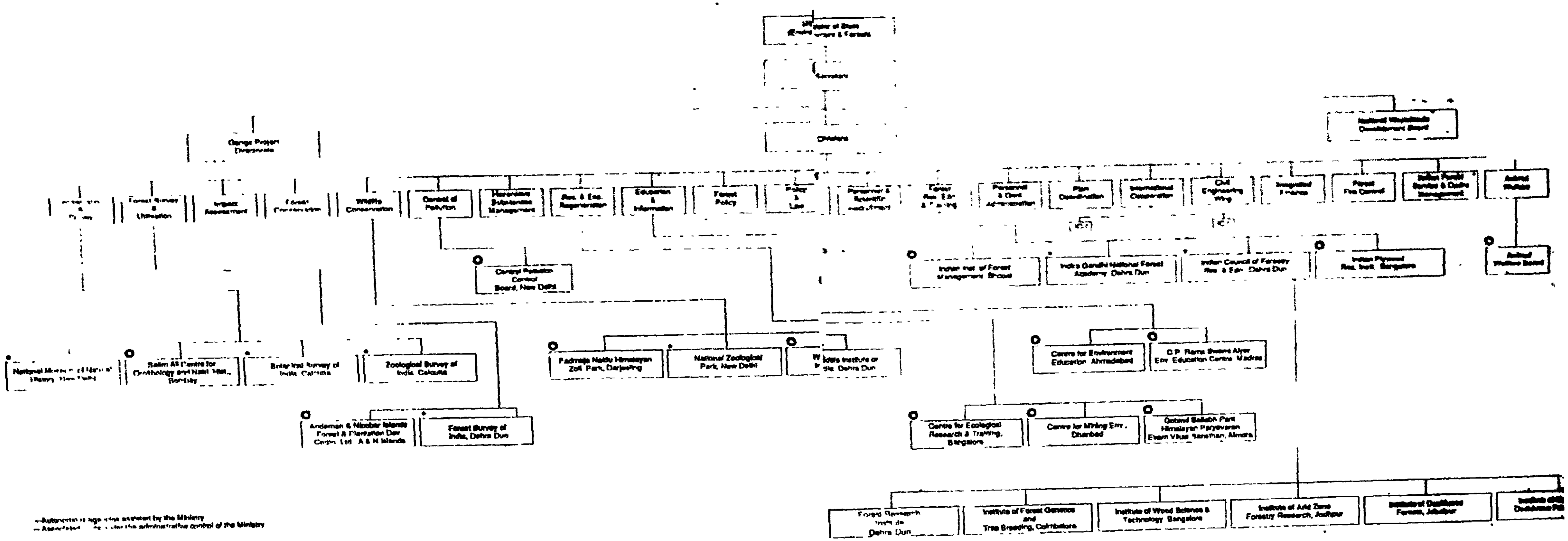
About 90% of the world food comes from 20 plant species. The plant breeders find that they have to turn more and more to the wild species to introduce into the cultivated forms desired qualities of resistance to pests and diseases and the ability to withstand adverse soil and weather conditions. India's biological diversity is very rich but unfortunately its wealth is being eroded due to various reasons. This diversity needs to be preserved and the immediate task will be to devise and enforce time bound plans for saving the endangered plant and animal species as well as habitats of biological resources. Action for conservation must be directed to:

- Intensification of surveys and inventorisation of biological resources in different parts of the country including the island ecosystems. The survey should include information on distribution pattern of particular species/ population/ communities and the status of ethnobiologically important groups;

- Conservation of biodiversity through a network of protected areas including Biosphere REserves, Marine REserves, National Parks, Sanctuaries, Gene Conservation Centres, Wetlands, Coral Reefs and such other natural habitats of biodiversity. This should include taxonomic and ecological studies on the flora and fauna with adequate emphasis placed on the lower vertebrate, invertebrate and micro-flora which are important in contributing to the healthy maintenance of ecosystems;
- Full and correct rehabilitation of rural poor/ tribals displaced due to creation of national parts/ biosphere reserves/ tiger reserves;
- Conservation of micro-fauna and micro-flora which help in reclamation of wastelands and revival of biological potential of the land;
- Protection and sustainable use of plant and animal genetic resources through appropriate laws and practices;
- Protection of domesticated species/ varieties of plants and animals in order to conserve indigenous genetic diversity.

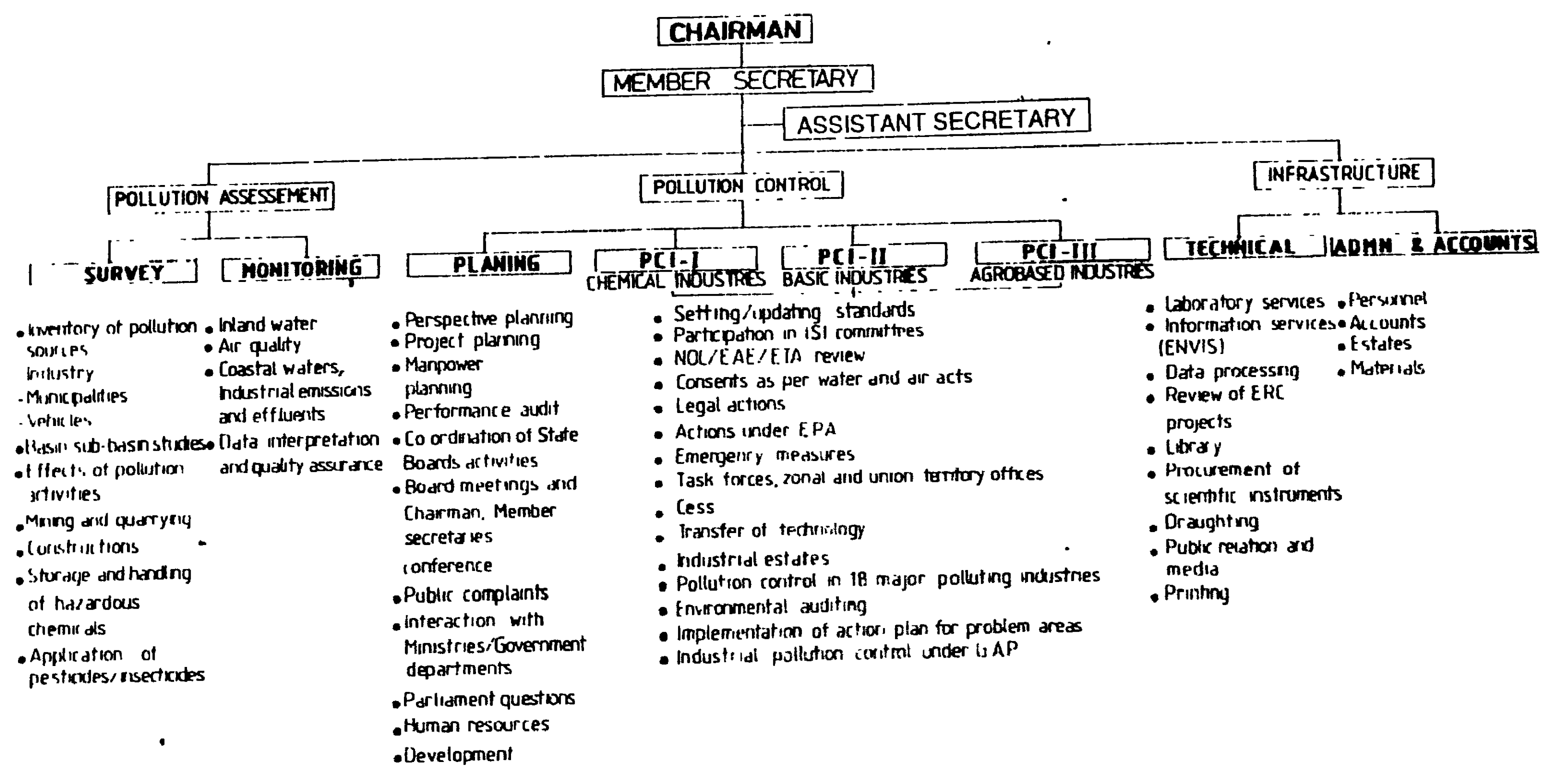
ANNEXURE I

ORGANISATION CHART OF THE MINISTRY OF ENVIRONMENT & FORESTS



APPENDIX II

ORGANISATIONAL STRUCTURE OF CENTRAL POLLUTION CONTROL BOARD



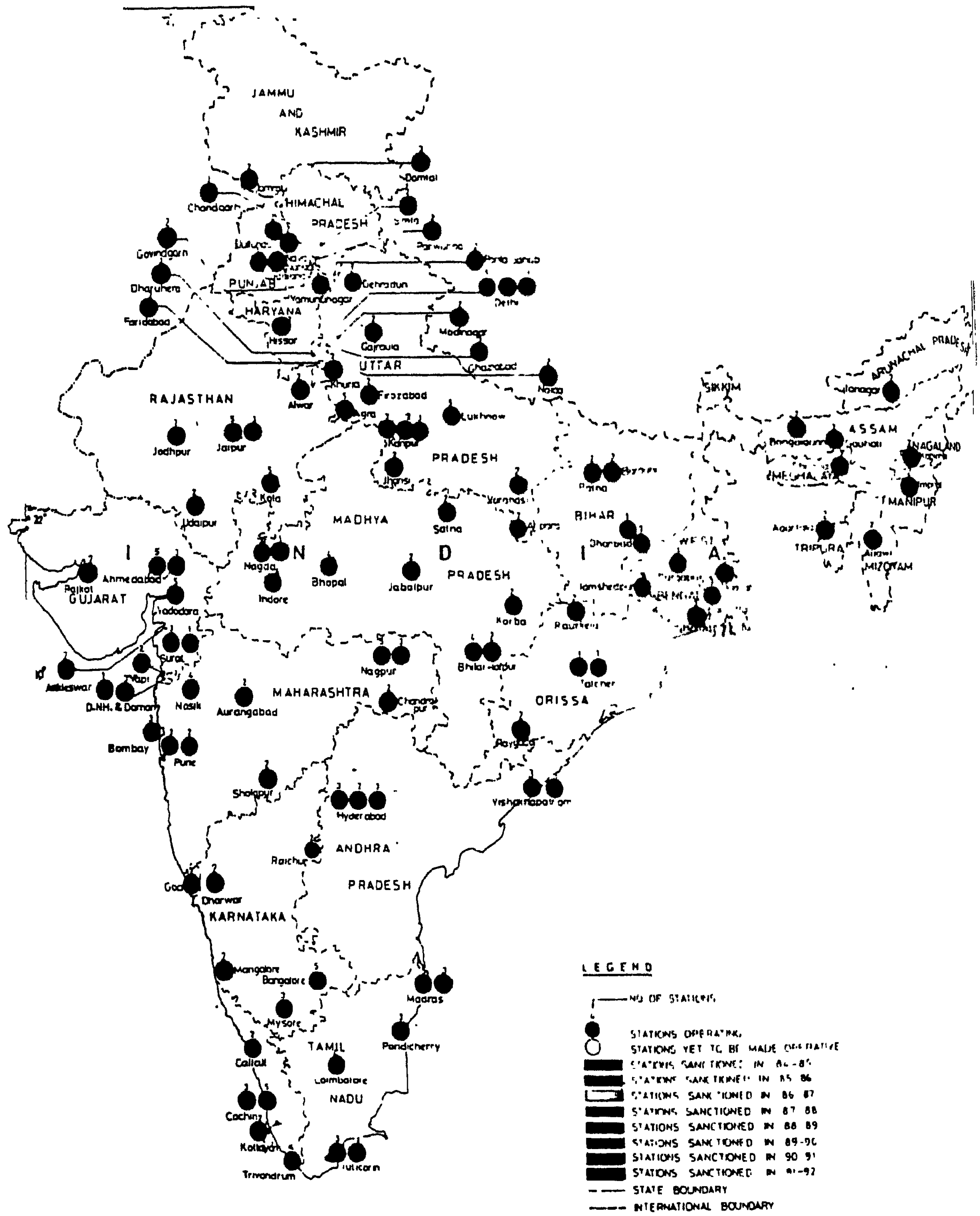
5.4.1.2 **Inventorisation of Polluting Industries**

The inventory of large and medium water polluting industries in the country is under compilation. So far, information on 17 States and 4 Union Territories have been compiled and a summary is presented in Table 3.

Table 3. **STATUS OF LARGE MEDIUM INDUSTRIES IN INDIA**

S No	Name of State	Total Units 1984	Total Units 1990	Units having E.T.P. 1984	Units having E.T.P. 1990	STATE CODE
1.	Andhra Pradesh	340	546	105	254	ANP
2	Assam	20	27 **	11	25 **	ASM
3	Bihar	99	230	21	48 **	BIH
4	Goa	20	23	11	13	GOA
5	Gujarat	431	552	369	409	GUJ
	Haryana	297	350 **	49	113 **	HAR
7.	Himachal Pradesh	30	69	30	43	HPR
8	Karnataka	289	694	274	633 **	KAR
9	Kerala	149	300 **	67	155 **	KER
10	Madhya Pradesh	195	345	59	127	MPR
11	Maharashtra	810	1550 **	651	1300 **	MAR
12.	Orissa	115	216 **	72	166 **	ORI
13	Punjab	136	367	52	252	PUN
14	Rajasthan	138	250	43	100 **	RAJ
15.	Tamil Nadu	306	800	54	178 **	TND
16.	Uttar Pradesh	253	476	126	291 **	UPR
17	West Bengal	333	550 **	51	118 **	WBL
	Union Territories					
.	Chandigarh	14	19	5	12	CHD
2	Daman and Diu	Nil	13	Nil	1	DNH
3	Delhi	63	66	16	37 **	DEL
4	Pondicherry	16	57	8	15	PON
	GRAND TOTAL	4054	7500	2076	4300	

**Projected Figures



AIR QUALITY MONITORING STATIONS IN INDIA

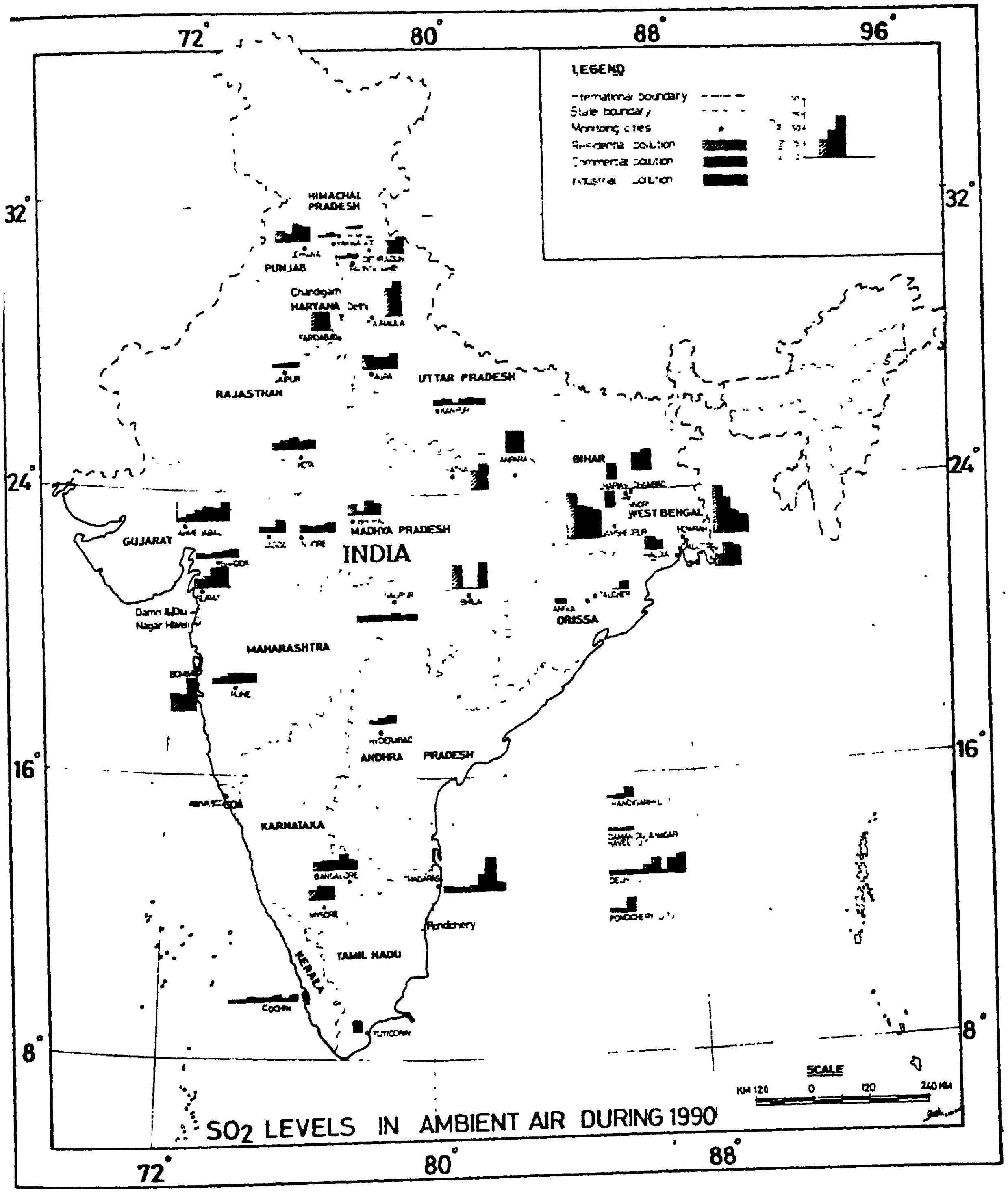
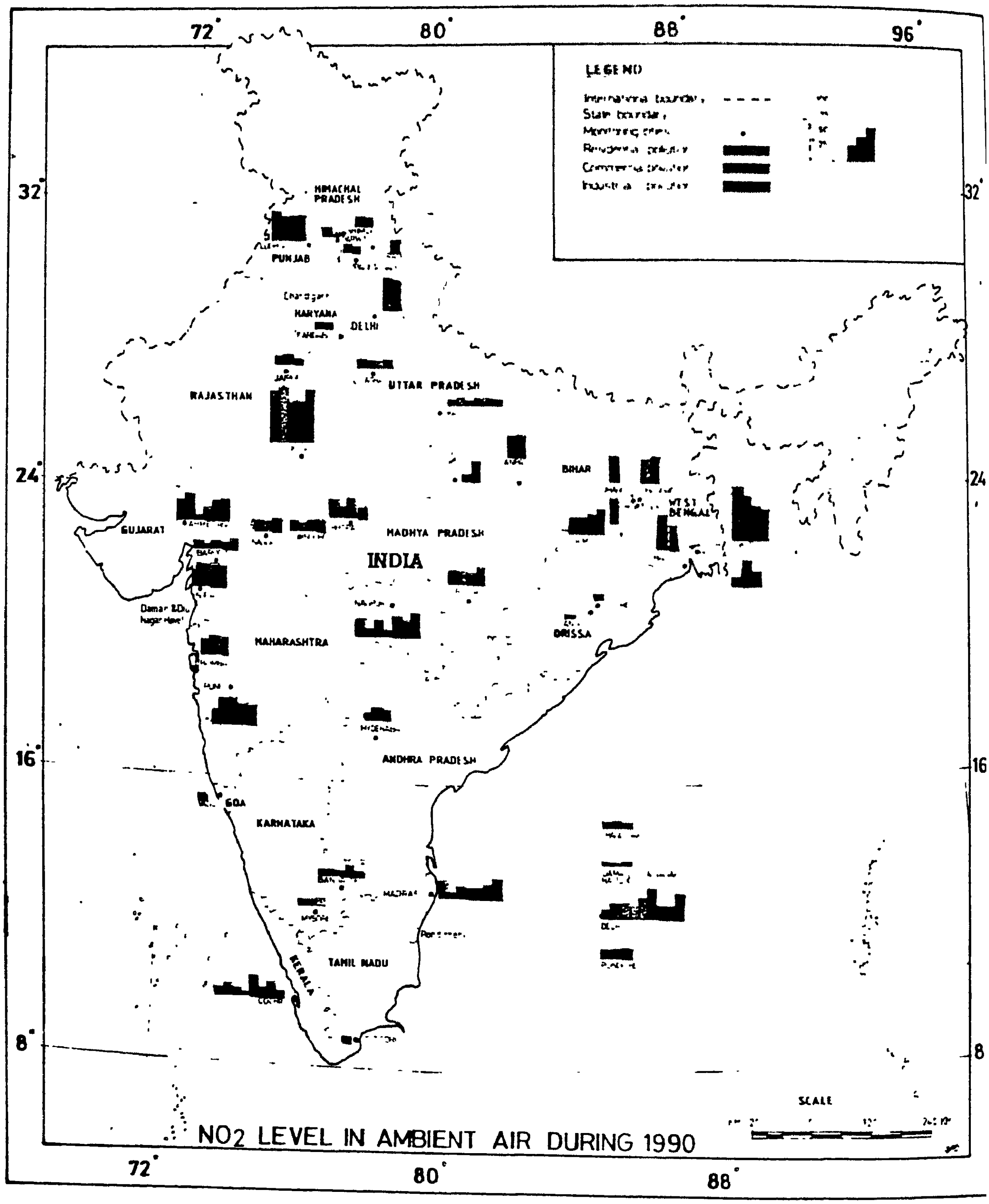
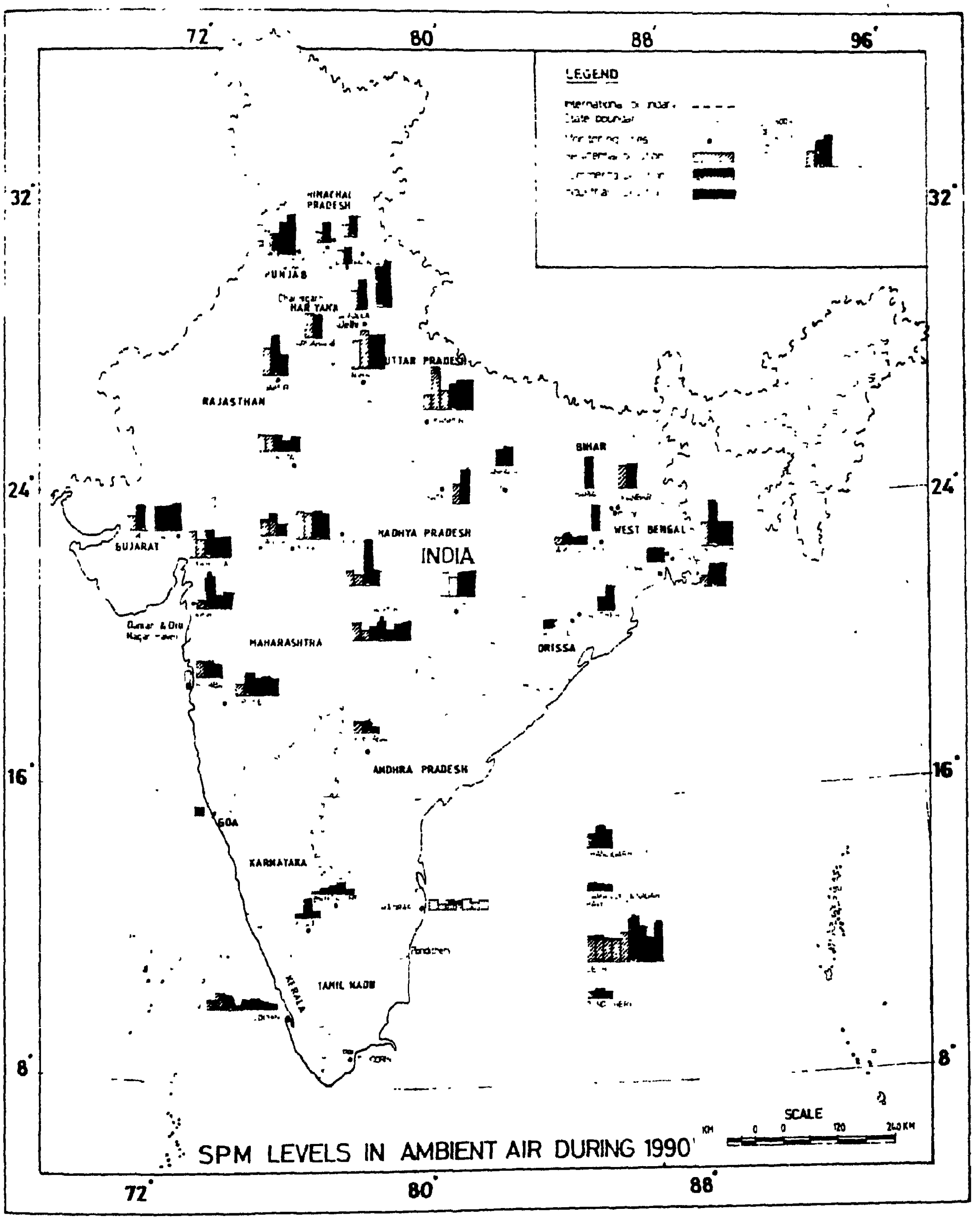


FIG. 6.7 SO_2 LEVEL IN AMBIENT AIR DURING 1990 IN INDIA



NO_2 LEVEL IN AMBIENT AIR DURING 1990 IN INDIA



SPM LEVEL IN AMBIENT AIR DURING 1990 IN INDIA

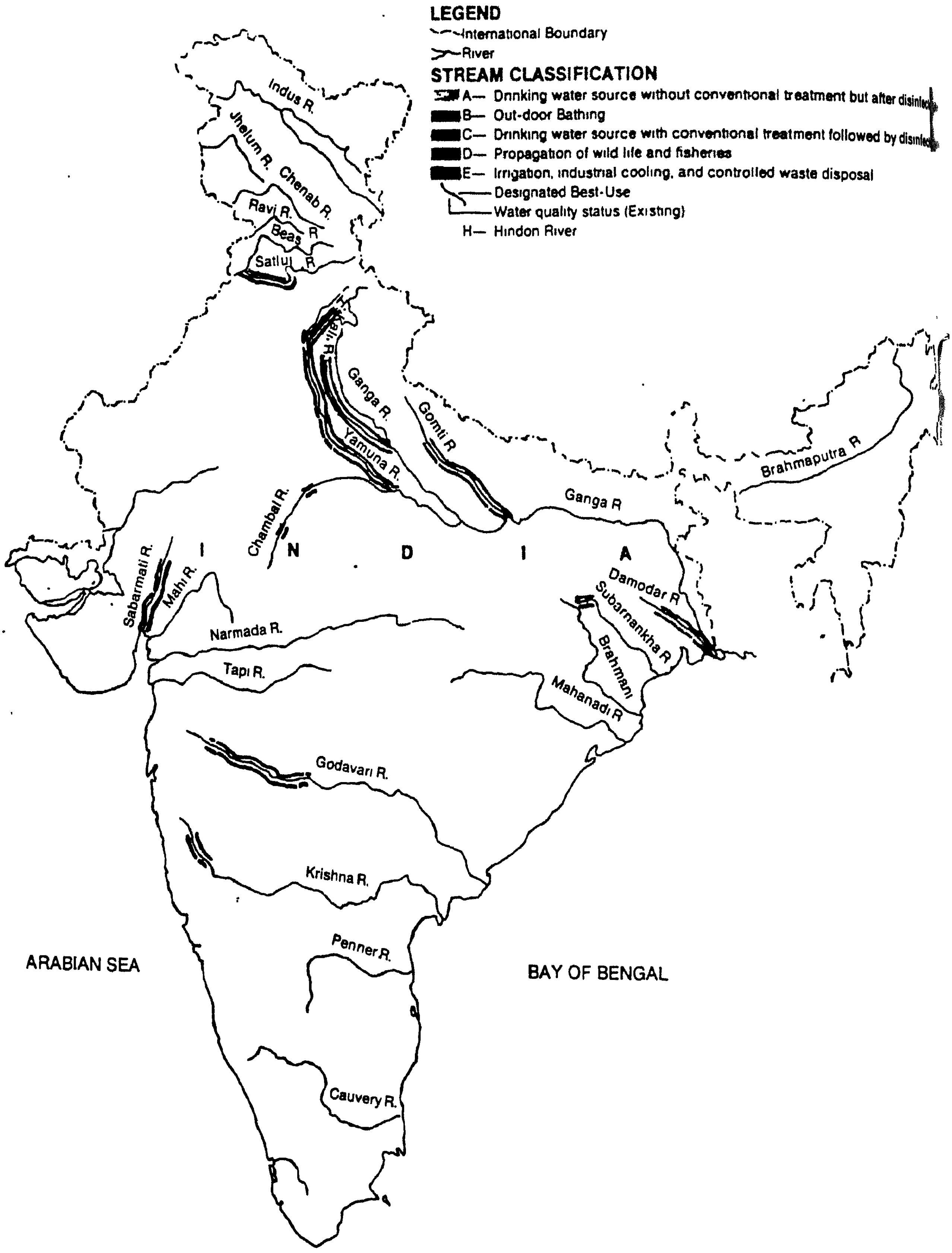


Fig. 22 Grossly Polluted River Stretches

Table 6 LIST OF POLLUTED RIVER STRETCHES

River		Polluted stretch	Desired Class	Existing Class	Critical Parameters	Possible Source of Pollution
Sabarmati	(i)	Immediate u/s of Amhedabad city upto Sabarmati Ashram	B	E	DO, BOD Coliforms	Domestic and industrial waste from Ahmedabad
	(ii)	Sabarmati Ashram to Vautha	D	E	—do—	Domestic and industrial wastes from Ahmedabad
Subarnarekha		Hatia Dam to Bharagora	C	D/E	—d—	Domestic and Industrial waste from Ranchi and Jamshedpur
Godavari	(i)	D/S of Nasik to Nanded	C	D/E	BOD	Wastes from Sugar, Distillery and food processing industries
	(ii)	City limit of Nasik and Nanded	B	—do—	—do—	—do—
Krishna		Karad to Sangli	C	D/E	BOD	Wastes from Sugar industries and Distilleries
Indus (Tributary)						
(i) Sutlej		D/S of Ludhiana to Hanke	C	D/E	DO, BOD	Industrial wastes from Hosieries, Tanneries, Electroplating and Engg. industries and domestic waste from Ludhiana and Jalandhar
		D/S of Nangal to Anandpur	C	E	Ammonia	Wastes from Fertiliser and Chlor-alkali mills from Nangal
Ganga (Tributaries/sub-tributaries)						
(i) Yamuna	(a)	Delhi to Confluence with Chambal	C	D/E	DO, BOD Coliforms	Domestic and industrial wastes from Delhi, Mathura and Agra
	(b)	In the city limits of Delhi, Mathura & Agra	B	—do—	—do—	—do—
Hindon		Saharanpur to confluence with Yamuna	D	E	DO, BOD, Toxicity	Industrial and domestic wastes from Saharanpur and Ghaziabad
Chambal		D/S of Nagda and D/S Kota (app. 15 kms at both the places)	C	D/E	BOD, DO	Domestic and Industrial wastes from Nagda and Kota
(ii) Damodar		D/S of Dhanbad of Haldia	C	D/E	BOD, Toxicity	Industrial wastes from Dhanbad, Durgapur, Asansol, Haldia and Burnpur
(iii) Gomti		Lucknow to confluence with Ganga	C	D/E	DO, BOD Coliforms	Industrial wastes from Distilleries and domestic wastes from Lucknow
(iv) Kali		D/S Modinagar to confluence with Ganga	C	D/E	BOD, Coliforms	Industrial and domestic wastes from Modinagar

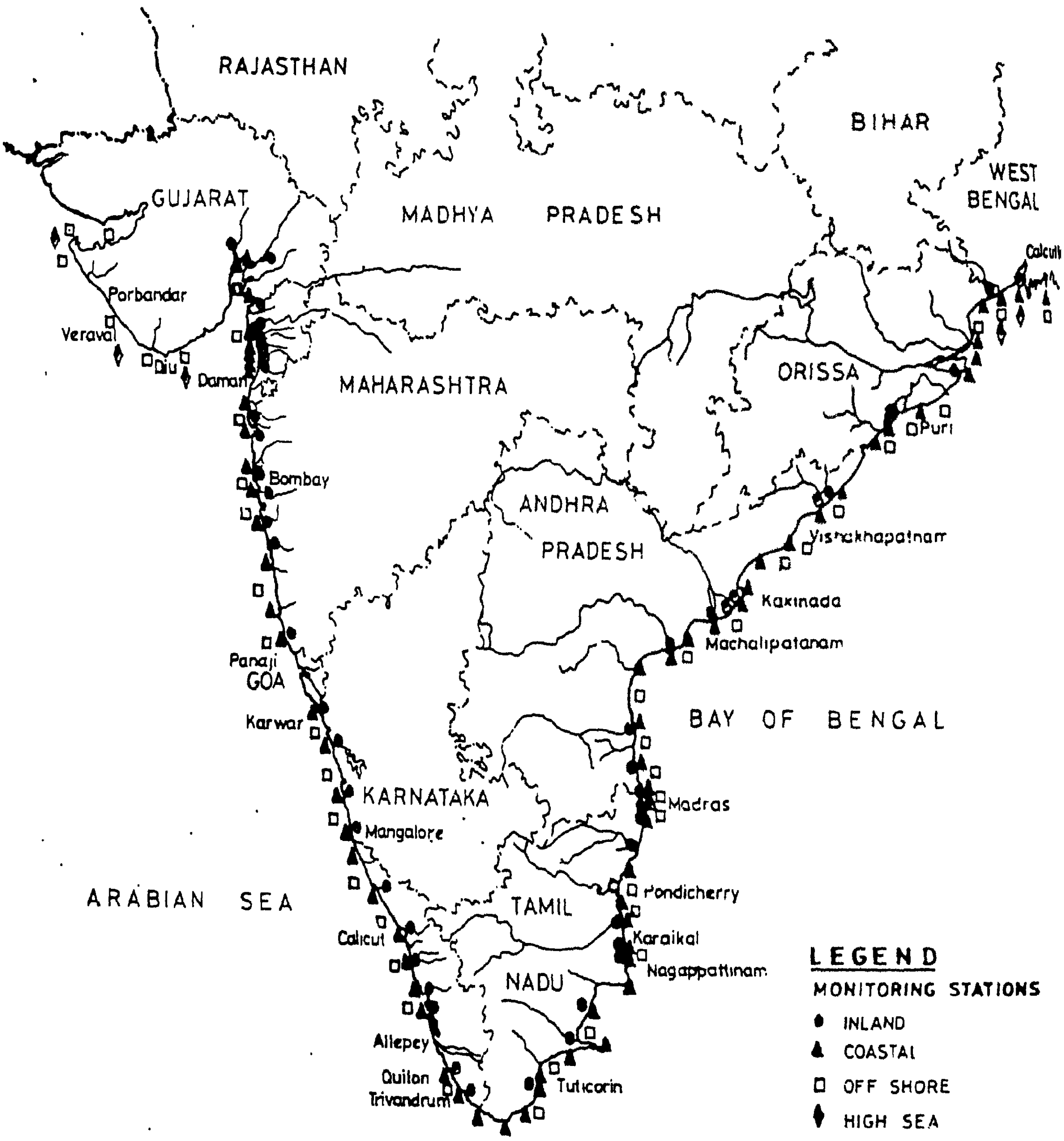


Figure 8. MAP SHOWING COASTAL MONITORING LOCATIONS



Fig. 21: Problem Areas in India

Table 2 QUANTUM OF POLLUTION LOAD GENERATED IN THE IDENTIFIED PROBLEM AREAS

Water Pollution

S. No.	Location	Water Pollution Load (tonne/day) SS	BOD	COD	O&G
1.	Pali	32 5	8.97	46 5	—
2	Korba	77.0	2 40	—	—
3	Talcher	174 2	1.21	3 9	—
4	Greater Cochin	2 0	1 0	3 3	—
5	Gobindgarh	No Significant Water Pollution			
6	Manali	7 0	10.6	23 75	21.25
7	Vishakhapatnam	11 8	35.3	375	—
8	Vapi	4.7	49.9	109	6.85
-	Najafgarh Drain	119 2	77.3	230	—
10	Chembur	38.29	69 5	—	—

Air Pollution

S No	Location	Air Pollution Load (Tonne/day) Particulate matter	SO_2	NO_2	Others
1	Pali	No Significant Air Pollution			
2	Korba	482	183.0	—	—
3	Talcher	488	68.8	72.2	39.4
4	Greater Cochin	1.30	2.10	—	1.5 (NH_3)
-	Gobindgarh	23.99	18.01	6.63	0.4 (CO)
6	Manali	34.80	25.50	1.80	113.6 (NH_3 - 80 0) (HC - 33.6)
7	Vishakhapatnam	41.09	49.09	—	158.0 (HC)
8	Vapi	0.72	2.39	0.32	0.86 (CO)
9	Najafgarh Drain	Air pollution not considered in survey			
10	Chembur	0 7	28.90	5.8	7.93

EPA AND MINAS STANDARDS

A. EPA STANDARDS

(i) EPA STANDARDS FOR DISCHARGE OF LIQUID EFFLUENTS

Parameter	Maximum Permissible Concentration	
Caustic Soda Industry		
Mercury in the final effluent*	0.01 mg/l	
Mercury bearing waste water generation (flow)	10 Kilolitres/tonne of caustic soda produced	
pH	5.5 to 9.0	

* Final effluent is the combined effluent from (a) cell house, (b) brine plant, (c) chlorine handling, (d) hydrogen handling, (e) hydrochloric acid plant.

Parameter	Maximum Permissible Concentration	
Man-made Fibres (Synthetic)		
Suspended soilds	100 mg/l	
Bio-chemical oxygen demand, 5 days 20 Deg.C	30	
pH	5.5 to 9.0	
Oil Refinery Industry		Quantum, kg/1000 tonnes crude processed not to exceed
Oil and grease	10 mg/l	7 mg/l
Phenol	1 mg/l	0.7 mg/l
Sulphide	0.5 mg/l	0.35 mg/l
Bio-chemical oxygen demand, 5 days 20 Deg.C	15 mg/l	10.5 mg/l
Suspended Solids	20 mg/l	14 mg/l
pH	6 to 8.5	—
Sugar Industry		
Bio-chemical oxygen demand, 5 days 20 Deg.C	100 mg/l for disposal on land, 30 for disposal in surface waters	
Suspended Solids	100 mg/l for disposal on land, 30 for disposal in surface waters.	
Total Chromium	2 mg/l	

Parameter	Maximum Permissible Concentration
Dyes and Dye-Intermediate Industry	
Suspended Solids	100 mg/l
pH	6 to 8.5
Temperature	Shall not exceed 5 Deg.C above the ambient temperature of the receiving body.
Mercury (as Hg)	0.01 mg/l
Hexavalent Chromium	0.1 mg/l
Total Chromium (as Cr)	2.0 mg/l
Copper (as Cu)	3.0 mg/l
Zinc (as Zn)	5.0 mg/l
Nickel (as Ni)	3.0 mg/l
Cadmium (as Cd)	2.0 mg/l
Chloride (as Cl)	1000 mg/l
Sulphate (as SO4)	1000 mg/l
Phenolic Compounds (as C6H5OH)	10
Oil and Grease	10
Bio-assay Test (with 1:8 dilution of (effluents)	90% survival of test animals after 96 hours.

The standards for chlorides and sulphates are applicable for discharge into inland and surface water course. However, when discharged on land for irrigation, the limit for chloride shall not be more than 600 milligram per litre and the sodium absorption ratio shall not exceed 26.

Electroplating Industries	
pH	6.0 to 9.0
Temperature	shall not exceed 5 deg.C above the ambient temperature of the receiving body.
Oil and Grease	10 mg/l
Suspended Solids	100 mg/l
Cyanides (as CN)	0.2 mg/l
Ammonical Nitrogen (as N)	50 mg/l
Total Residual Chloride (as C1)	1.0 mg/l
Cadmium (as Cd)	2.0 mg/l
Nickel (as Ni)	3.0 mg/l
Zinc (as Zn)	5.0 mg/l
Hexavalent Chromium (as Cr)	0.1 mg/l

Parameter	Maximum Permissible Concentration
Total Chromium (as Cr)	2.0 mg/l
Copper (as Cu)	3.0 mg/l
Lead (as Pb)	0.1 mg/l
Iron (as Fe)	3.0 mg/l
Total Metal	10.0 mg/l
Coke Ovens	
pH	5.5-9.0
Bio-chemical Oxygen demand (20 Deg.C for 5 days)	30 mg/l
Suspended Solids	100 mg/l
Phenolic Compounds (AsC6H5OH)	5 mg/l
Cyanides (as CN)	0.2 mg/l
Oil and Grease	10 mg/l
Ammonical Nitrogen (as N)	50 mg/l
Synthetic Rubber Industry	
Colour and Odour	Absent
pH	5.5-9.0
Bio-chemical oxygen demand (20 deg.C for 5 days)	50 mg/l
Chemical oxygen demand	250 mg/l
Oil and grease	10.0 mg/l
Pulp and Paper Industry	
pH	6.0-8.5
Suspended Solid	100 mg/l
BOD (5 days 20 deg.C)	
—Discharge into surface water	30 mg/l
—Disposal on land	100 mg/l
Sodium Absorption Ratio	26
Fermentation Industry (Distilleries, Maltries & Breweries)	
pH	5.5-9.0
Colour and Odour	Absent
Suspended Solids	100 mg/l
BOD (5 days at 20 deg.C)	
—Disposal into inland surface waters	30 mg/l

Parameter	Maximum Permissible Concentration
—Disposal on land	100 mg/l*

* 500 mg/l - The Gazette of India Extraordinary, Part II - Section 3 Sub-section (ii), January 8, 1990.

Straight Nitrogenous Fertilizers excluding the Calcium Ammonium Nitrate and Ammonium Nitrate Fertilizers

		Plants Commissioned	
		after 1.1.82	**before 1.1.82**
pH		6.5-8.0	6.5-8.0
Ammonical Nitrogen	mg/l	50	75
Total Kjeldahl Nitrogen	mg/l	100	150
Free Ammonical Nitrogen	mg/l	4	4
Nitrate Nitrogen	mg/l	10	10
Cyanide (as CN)	mg/l	0.2	0.2
Vanadium (as V)	mg/l	0.2	0.2
Arsenic (as As)	mg/l	0.2	0.2
Suspended Solids	mg/l	100	100
Oil and Grease	mg/l	10	10
*Hexavalent Chromium (as Cr)	mg/l	0.1	0.1
*Total Chromium (as Cr)	mg/l	2.0	2.0

Straight Nitrogenous Fertilizers including Calcium Ammonium Nitrate and Ammonium Nitrate Fertilizers

pH		6.5-8.0	6.5-8.0
Ammonical Nitrogen	mg/l	50	75
Total Kjeldahl Nitrogen	mg/l	100	150
Free Ammonical Nitrogen	mg/l	4	4
Nitrate Nitrogen	mg/l	20	20
Cyanide (as CN)	mg/l	0.2	0.2
Vanadium (as V)	mg/l	0.2	0.2
Arsenic (as As)	mg/l	0.2	0.2
Suspended Solids	mg/l	100	100
Oil and Grease	mg/l	10	10
*Hexavalent Chromium (as Cr)	mg/l	0.1	0.1
*Total Chromium (as Cr)	mg/l	1.0	1.0

Complex fertilizers excluding Calcium Ammonium Nitrate, Ammonium Nitrate and Ammonium Nitrophosphate Fertilisers

pH		6.5-8.0	6.5-8.0
Ammonical Nitrogen	mg/l	50	75
Free Ammonical nitrogen	mg/l	4	4
Total Kjeldahl Nitrogen	mg/l	100	150
Nitrate Nitrogen	mg/l	10	10
Cyanide (as CN)	mg/l	0.2	0.2
Vanadium (as V)	mg/l	0.2	0.2
Arsenic (as As)	mg/l	0.2	0.2
Phosphate (as P)	mg/l	5	5
Oil and Grease	mg/l	10	10
Suspended Solids	mg/l	100	100
Fluoride (as F)	mg/l	10	10
**Hexavalent Chromium (as Cr)	mg/l	0.1	0.1
**Total Chromium (as Cr)	mg/l	2.0	2.0

		6.5-8.0	6.5-8.0
Ammonical Nitrogen	mg/l	50	75
Free Ammonical Nitrogen	mg/l	100	100
Nitrate Nitrogen	mg/l	20	20
Cyanide (as CN)	mg/l	0.2	0.2
Vanadium (as V)	mg/l	5	5
Arsenic (as As)	mg/l	0.2	0.2
Phosphate (as P)	mg/l	5	5
Oil and Grease	mg/l	10	10
Suspended Solids	mg/l	100	100
*Fluoride as F	mg/l	10	10
**Hexavalent Chromium (as Cr)	mg/l	0.1	0.1
**Total Chromium (as Cr)	mg/l	2.0	2.0

Straight Phosphatic Fertilizers

pH	7.0-9.0
Phosphate (as P)	5 mg/l
Oil and Grease	10 mg/l
Suspended Solids	100 mg/l
*Fluoride (as F)	10 mg/l
**Hexavalent Chromium (as Cr+6)	0.1 mg/l
**total Chromium (as Cr)	2.0 mg/l

*To be complied with at the outlet of fluoride removal unit. If the recipient system so demands, fluoride as F shall be limited to 1.5 mg/l.
**To be complied with at the outlet of chromate removal unit.

Leather Tanneries

		Inland surface Waters	Public sewers	Land for Irrigation	Marine Coastal areas
Suspended Solids	mg/l	100	600	200	100
BOD-5 days at 20 Deg.C	"	30	350	100	100
pH		6.0-9.0	6.0-9.0	6.0-9.0	6.0-9.0
Chlorides	mg/l	1000	1000	600	-
Hexavalent Chromium (as Cr)	"	0.1	0.2	0.1	1.0
Total Chromium (as Cr)	"	2.0	2.0	2.0	2.0
Sulphides (as S)	"	2.0	5.0	-	5.0
Sodium percent	"	-	60	60	-
Boron (as B)	"	2.0	2.0	2.0	-
Oil and Grease	"	10	20	10	20

(ii) EPA STANDARDS FOR GASEOUS EMISSIONS

Industry	Parameter	Maximum Permissible concentration
Cement Plants		
Plant Capacity		
a. 200 TPD Plants	Particulate matter	250 mg/NM3-Protected area
	-do-	400 mg/NM3-Other area
b. Greater than 200 TPD Plants		150 mg/nm3-Protected area
		250 mg/NM3-Other area
Aluminium Plants		
Process		
1. Calcination	Particulate matter	250 mg/NM3
2. Smelting	Particulate matter	150 mg/NM3
	Fluorine	1 kg Fluorine per tonne of aluminium produced.

Industry	Parameter	Maximum Permissible concentration
Calcium Carbide Plant		
Process Plant		
Kiln	Particulate matter	250 mg/NM3
Arc Furnace	"	150 mg/NM3
Copper, Lead and Zinc smelting Plants		
Process Plant		
Concentrator	Particulate matter	150 mg/NM3
Smelter and Converter	Oxides of Sulphur	Off-gases must be utilised for sulphuric acid manufacture. Emission from the stack shall not exceed 4 kg/T concentrated acid (100 percent) produced.
Nitric Acid Plants	NOx	3 kg/Tonne of weak acid (before concentration) produced.
Sulphuric Acid Plants		
Process Plants		
1. Single Conversion Single Absorption	SO2	10 kg/tonne of concentrated and (100 percent) produced.
	Acid Mist	50 mg/NM3
2. Double Conversion Double Absorption (DCDA)	SO2	4 kg/tonne of concentrated acid (100 percent) produced.
	Acid Mist	50 mg/NM3
Fertilizer Plants		
a. Phosphatic Fertilizer plants		
i. Acidification of rock phosphate	Fluoride	25mg/NM3 as total Fluoride
ii. Granulation mixing, rock grinding	Particulate matter	150mg/NM3 from each process
b. Urea Plants		
Old Prilling Tower	Particulate matter	150mg/NM3 or 2 kg/tonne of product.
New Prilling Tower (commissioned after 1-1-1982)	Particulate matter	50mg/NM3 or 0.5kg/tonne of product.

Annexure 2.2 (Contd.)

Industry	Parameter	Maximum Permissible concentration
Integrated Iron and Steel plants		
a. Sintering Plant	Particulate matter	150mg/NM3
b. Steel making - during normal operations	Particulate matter	150mg/NM3
during oxygen landing	Particulate matter	400mg/NM3
c. Rolling Mill		150mg/NM3
d. Coke Oven produced	Carbonmonoxide	3kg/tonne of coke
Oil Refineries		
A. Distillation (Atmospheric plus vacuum)	SO2	0.25kg/tonne of crude produced
B. Catalytic cracker	SO2	2.5kg/tonne of feed
C. Sulphur recovery unit	SO2	120kg/tonne of sulphur in the feed
D. In absence of CO boiler from all plants	Carbon monoxide	500mg/NM3
Carbon Elack Plants		
New Plants - built and commissioned after January 1,1985	Particulate matter	150mg/NM3
Existing Plants - built and commi-ssioned before December 31,1984		250mg/NM3 till 31-12-86 150mg/NM3 from 01-01-87
Existing as well as new plants		To install after burners for reactor off-gas by December 1987.
Caustic Soda Industry		
Mercury cell	Mercury from hydrogen gas holder stack	0.2mg/l
All Process	Chlorine from hypotower	15mg/l
All Process	Hydrochloric vapour and mist from hydrochloric acid plant	35mg/l
Pulp and Paper	Particulare matter	250 NM3
	H2S	10 NM3

B. MINAS STANDARDS

Pesticide Manufacturing and Formulation Industry

Compulsory Parameters	Concentration
Temperature	shall not exceed 5 deg.C above the receiving body temperature
pH	6.5 to 8.5
Oil and grease	10 mg/l
Bio-chemical Oxygen Demand	30 mg/l
Total suspended solids	100 mg/l
Bioassay test	90% survival of fish after 96 hrs. in 100% effluent.

Optional Parameters

a) Specific Pesticides	
- Benzene hexachloride	10
- Carbaryl	10
- DDT	10
- Endo sulfan	10
- Dimethoate	450
- Fenicrothion	10
- Malathion	10
- Phorate	10
- Methyl Parathion	10
- Phenthoate	10
- Pyrothrums	10
- Copper Oxychloride	9600
- Copper sulphate	50
- Ziram	1000
- Sulphur	30
- 2,4 D	400
- Paraquat	23000
- Propanil	7300
- Nitrofen	780

b) Heavy Metals	**Limiting concentration not to exeed, mg/l**
- Copper	1
- Manganese	1
- Zinc	1
- Mercury	0.01
- Tin	0.1
- Any other like nickel etc.	shall not exceed 5 times the drinking water standards (BIS)
c) Organics	
- Phenol and phenolic compounds as C6H5OH	1.0
d) Inorganics	
- Arsenic as As	0.2
- Cyanide as CN	0.2
- Nitrate as NO3	50
- Phosphate as P	5

1. Pesticides are known to have metabolites and isomers. If they are found in significant concentration, standards may be prescribed for these in optional list by State Board.
2. Industries are advised to analyse pesticides in wastewater by advanced analytical methods such as GLC.

Small Scale Industry

Parameters	**Concentration not to exceed in mg/l (except pH. Temperature and Bioassay Test)**
- Mercury (Hg)	0.01
- pH	5.5-9.0
- Suspended Solids	250
- Biochemical Oxygen Demand	150
- Temperature	shall not exceed 5 deg.C above the ambient Temperature of the receiving body.
- Free Available Chlorine	0.5
- Oil and grease	10
- Copper (Total)	5.0
- Iron (Total)	3.0
- Zinc	5.0
- Chromium (Total)	2.0
- Phosphate (as P)	5.0

- Bio-assay test	90% of test animals survival after 96 hours with 1:8 dilution
- Tin	0.1
- Sulphide (as S)	2
- Phenolic Compounds (as C6H5OH)	5
- Hexavalent Chromium (as Cr)	0.1
- Nickel (as Ni)	3.0
- Cadmium (Cd)	2.0
- Chloride (as C1)	1000
- Sulphate (as SO4)	1000
- Cyanides (as CN)	0.2
- Ammonical Nitrogen (as N)	50
- Lead (as Pb)	0.1
- Total Metal	10.0

Note : The standards may be relaxed in cases where the waste-water from small scale industrial units are collected and treated in a Terminal Treatment Plant.

Pharmaceutical and Formulation Industry

Compulsory Parameters

pH	5.5-9.0
Oil and grease	10 mg/l
Total Suspended Solids	100 mg/l
Bio-chemical Oxygen Demand	30 mg/l
Bio-assay test	(90% survival of fish after 96 hours in 100% effluent).

Optional Parameters

Mercury	0.01 mg/l
Arsenic	0.2 mg/l
Chromium (Hexavalent)	0.1 mg/l
Lead	0.1 mg/l
Cyanide	0.1 mg/l
Phenolics (as C6H5OH)	1.0 mg/l
Sulphides (as S)	2.0 mg/l
Phosphate (as P)	5.0 mg/l

Note : The optional parameters are applicable to pharmaceutical manufacturing units depending upon the process and products. Formulators are exempted from the optional parameters.

Petrochemicals Industry

pH	6.5-8.5
BOD (5 days 20 deg.C)	50 mg/l
COD	250 mg/l
Phenol	5 mg/l
Sulphide (as S)	2 mg/l
Cyanide (as CN)	0.2 mg/l
Fluoride (as F)	15 mg/l
Hexavalent Chromium (as Cr)	0.1 mg/l
Total Chromium (as Cr)	2 mg/l
Total Suspended Solids	100 mg/l

1) State Boards may prescribe the BOD vale of 30 mg/l if the recipient system so demand.

2) The limit for phenol shall be conformed to at the outlet of effluent treatment of phenol cumene plant. However, at the final disposal point, the limit shall be less than 1 mg/l.

3) The limit for fluoride shall be conformed to at the outlet of fluoride removal unit. However, at the disposal point fluoride concentration shall be lower than 5 mg/l.

4) The limits for total and hexavalent chromium shall be conformed to at the outlet of the chromate removal unit. This implies that in the final treated effluent, total and hexavalent chromium shall be lower than prescribed herein.

C. CENTRAL POLLUTION CONTROL BOARD (CPCB) EMISSION STANDARDS FOR PROCESS INDUSTRIES

Industry	Process	Emission Standards
Aluminium	Calcination	250 mg/Nm3 of Particulate Matter (PM)
	Smelting	a. 1 kg F/Te Al produced b. 150 mg/Nm3 PM
Calcium Carbide	Kiln	250 mg/Nm3 PM
	Arc furnace	150 mg/Nm3 PM
Carbon Black		a. 150 mg/Nm3 PM b. CO - To install after burners for reactor off gases by Dec. 1987.

Annexure 2.2 (Contd.)

Industry	Process	Emission Standards
Cement	200 TPD and less	250mg/Nm3(protected area) 400mg/Nm3(other area)
	Greater than 200 TPD	150mg/Nm3(protected area) 250mg/Nm3(other area)
Copper, Lead, and Zinc	Smelting	150mg/Nm3 PM Off gases from smelter and converter must go for H2SO4 manufacture. No release of SO2/SO3 shall be permitted.
Fertilizer	Nitric Acid	NOx - 3 Kg/Te of weak acid production.
	Phosphatic-acidification of rock phosphate	25 mg/Nm3 of F2
	Granulation,	150 mg/Nm3 of PM mixing and grinding
	H3FO4	0.65 Kg F2/Ton P2O5
	Urea prilling tower	50 mg/NM3 PM
	Single super-phosphate	0.1 Kg F2/Ton product
	Triple super-phosphate	0.075 Kg F2/ Ton product
Sulphuric Acid	SCSA	SO2 10 kg/Ton 100% acid. Acid mist 50 mg/Nm3.
	DCDA	SO2 4 Kg/Ton acid Acid mist 50 mg/NM3 (0.6 Kg SO3/Ton acid)
Oil Refineries	Distillation	SO2 0.25 Kg/ton feed
	Catalytic cracker	SO2 2.5 Kg/ton feed
	Sulphur recovery unit	120 Kg/ton of sulphur in the feed (SO2 3 Kg/ Ton crude processed; SO2 5 Kg/Te crude processed for catalytic regenerating unit-MINAS)

D. STACK HEIGHT REQUIREMENT BASED ON FUEL CONSUMPTION AND STEAM GENERATION

Steam Generation Capacity	Coal Consumed	Stack Height
Less than 2 ton/hr	8.5 MT/day	2.5 times the neighbouring building height or 9 meters (whichever is more)
More than 2 ton/hr to 5 ton/hr	8.5 MT/day to 21 MT/day	12 m
More than 5 ton/hr to 10 ton/hr	21 MT/day to 42 MT/day	15 m
More than 10 ton/hr to 15 ton/hr	52 MT/day to 64 MT/day	18 m
More than 15 ton/hr to 20 ton/hr	64 MT/day to 104 MT/day	21 m
More than 20 ton/hr to 25 ton/hr	104 MT/day to 105 MT/day	24 m
More than 25 ton/hr to 30 ton/hr	105 MT/day to 126 MT/day	27 m
More than 30 ton/hr	More than 126 MT/day	30 m or using formul H=14(Qg)^0.3* (whichever is more)

*H - physical height of the stack
Qg - emission of sulphur dioxide in kg/hr

Source :

EPA Notification, The Gazette of India-Extraordinary - Part II, Section 3, Subsection (II) January 18, 1988.

Table 26

Percentage of Urban Population without Access to Water Supply, Sanitation, and Education

State	Percentage of urban population without access to		
	Water Supply 1988	Sanitation 1988	Literacy 1991
Bihar	30.23	61.21	43.95
Uttar Pradesh	30.44	85.95	49.49
Andhra Pradesh	28.25	80.01	43.19
Karnataka	00.40	42.81	26.27
Orissa	62.20	66.22	28.38
Madhya Pradesh	19.00	89.68	41.18
West Bengal	30.49	67.82	33.51
Tamil Nadu	11.49	42.22	31.90
Rajasthan	01.41	23.78	45.93
Kerala	31.79	68.22	18.87
Maharashtra	00.30	37.60	31.82
Gujarat	08.13	22.49	35.19
Haryana	00.00	00.00	38.38
Assam			
Jammu & Kashmir	04.43	92.95	
Punjab	28.82	47.64	38.35
Himachal Pradesh	00.00	80.28	26.29
All India	**11.76**	**56.10**	**28.22**

Sources: 1. Ministry of Urban Development.
2. *Census of India*, Paper 2 of 1991.

Table 34

Mean Concentration of Pollutants in Industrial Locations, 1991.

City	SO_2	NOx	SPM
Bombay	33.4	30.9	199
Delhi	12.8	45.6	259
Madras	12.0	12.0	144
Calcutta	73.6	39.8	496
Ahmedabad	20.9	36.6	254

Table 35

Wastewater Generation, Collection & Treatment

States	Waste water (MLD)		Treatment	
	Generated	Collected	Primary	Primary & Secondary
Andhra Pradesh	780.60	163.40	-	174.54
Bihar	445.16	-		43.13
Gujarat	814.99	220.50		463.00
Haryana	130.21	38.53		-
Karnataka	654.75	462.26	326.82	10.18
Kerala	222.62	24.08	-	4.50
Maharashtra	2,837.75	190.00	292.92	9.08
Madhya Pradesh	551.97	168.20	85.30	-
Orissa	206.88	21.60	-	-
Punjab	232.97	158.26	-	-
Rajasthan	217.64	-	-	-
Tamil Nadu	486.92	53.14		-
Uttar Pradesh	1,449.41	255.00		160.00
West Bengal	1,107.42	27.30		19.80
Total	12,145.49	2,633.02		1,626.18

Note: The totals may not tally on account of smaller States having been left out of this table.

Source: Central Pollution Control Board (1989), Status of Water Supply and Waste water Collection & Treatment, New Delhi.

Table 36

Status of Water Supply and Waste water Collection and Treatment

City	Water Supply		Waste water generated		Disposal
	Estimated population million (1988)	Per capita (LPCD)	MLD	Treatment plant capacity	
Bombay	10.33	207.8	1,714.4	82.0	Creek & Sea
Delhi	7.46	258.0	1,480.0	745.0	River Yamuna
Calcutta	4.53	226.7	780.9	-	River Hooghly & Kulh
Hyderabad	2.70	241.6	522.0	140.0	Land
Ahmedabad	2.65	200.1	381.6	382.0	Sabarmati river
Bangalore	3.82	113.9	348.0	286.00	Valleys tank
Kanpur	1.77	307.0	325.6	160.00	Ganga
Pune	1.53	169.8	161.8	90	River

Source: Central Pollution Control Board (1989).

Status of Water Supply and Waste Water Collection Treatment and Disposal in Class I Cities, 1988

1.2 Air Quality Standards

Category	SPM	SO_2	CO	NO_2
	(all concentrations in ug/m^3)			
Industrial & Mixed area	500	120	5000	120
Residential & Rural(commercial)	200	80	2000	80
Sensitive	100	30	1000	30

Table 1.1 - PROPOSED NATIONAL AMBIENT AIR QUALITY STANDARDS

POLLUTANT	AVERAGING TIME	CONCENTRATION (ug/m^3)		METHOD OF MEASUREMENT
		General Area	Sensitive Area	
SO_2	Annual Avg*	80 (0.03 ppm)	30	- Improved West and Gaeke
	24 hrs	130 (0.05 ppm)	30	
	1 hour	655 (0.25 ppm)		- Ultraviolet fluorescence
NO_2	Annual Avg*	100 (0.053 ppm)	30	- Na- Arsenite Method
	24 hrs	200 (0.106 ppm)	30	- Gas phase Chemiluminescence
	1 hour	470 (0.25 ppm)		
SPM	Annual Avg*	200 (400 ug/m^3)#	100 (200 ug/m^3)	- High Volume Sampling,
	24 hrs	400 (800 ug/m^3)#	200 (400 ug/m^3)	- Average flow rate not less than 1.1m^3/mt

* Annual Arithmetic mean of minimum 104 measurements in a year taken twice a week 24 hourly at uniform interval.

\# Not more than 2% of the total number of observations in a year should exceed the figures presented within the brackets for SPM.

NOTE

1. The standards are values that are not to be equalled or exceeded.

2. Concentration expressed first in units in which it was promulgated. Equivalent units given in parentheses are based upon a reference temperature of 25°C and a reference pressure of 760 mm of mercury. All measurements of air quality are to be corrected to reference temperature of 25°C and a refrence pressure 760 mm of Hg (1,013.2 millibar): ppm in this table refers to ppm by volume.

3. National Air Quality Standard : The levels of air quality necessary with an adequate margin of safety, to protect the public health.

TABLE 1.1

Primary Water Quality Criteria

Designated Best Use	Class of Water	Criteria
Drinking water source without Conventional treatment but after disinfection	A	1. Total Coliforms Organism MPN/100ml shall be 50 or less. 2. pH between 6.5 and 8.5 3. Dissolved Oxygen 6mg/l or more 4. Biochemical Oxygen Deman 5 days 20°C 2mg/l or les
Outdoor bathing (Organised)	B	1. Total Coliforms organise MPN/100ml shall be 500 or less. 2. pH between 6.5 and 8.5 3. Dissolved Oxygen 5mg/l or more. 4. Biochemical Oxygen Demand 5 days 20°C 3mg/l or less.
Drinking Water source	C	1. Total Coliforms organism MPN/100ml shall be 5000 or less. 2. pH between 6.5to 8.5 3. Dissolved Oxygen 4mg/l or more 4. Biochemical Oxygen Deman 5 days 20°C 3mg/l or les
Propagation of Wild life, Fisheries	D	1. pH between 6.5 and 8.5 2. Dissolved Oxygen 4mg/l or more 3. Free Ammonia (as N) 1.2 mg/l or less.
Irrigation, Industrial Cooling, Controlled Waste	E	1. pH between 6.0 or 8.5 2. Electrical Conductivity at 25°C micro mhos/cm Max 2250. 3. Sodium absorption Ratio Max 26. 4. Boron, Max 2mg/l